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OGALLALA TRIBS

FLOODPLAIN MANAGEMENT STUDY

KEITH COUNTY, NEBRASKA

prepared by:

United States
Department of
Agriculture

Soil
Conservation
Service
Lincoln, Nebraska

for,

Twin Platte
Natural Resources
District
North Platte, Nebraska

Nebraska Natural
Resources Commission
Lincoln, Nebraska



October, 1994

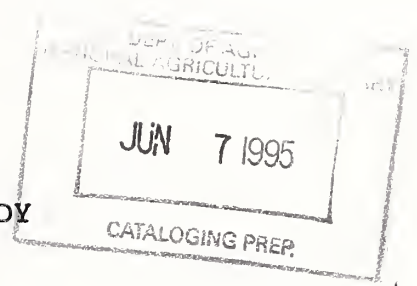
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OGALLALA TRIBUTARIES
FLOODPLAIN MANAGEMENT STUDY

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FLOODPLAIN MANAGEMENT STUDY

OGALLALA TRIBUTARIES

KEITH COUNTY

NEBRASKA

INTRODUCTION

The floodplains of rivers and streams have been formed by nature to provide for the conveyance of flood flows resulting from large amounts of snowmelt or rainfall. Floods are acts of nature which cannot be wholly prevented by man. Floodplains are as important to the stream system as the actual stream channel.

The long-term solution to reducing flood damage and loss of life is to keep the floodplain free of development which could be damaged or which could obstruct the conveyance of flood waters. Some basic public actions which can be used to keep floodplain areas free of development are:

1. Provide public information to make lending institutions and prospective property buyers aware of the flood hazards.
2. Initiate floodplain regulations to prevent the development of the floodplain in a manner which would be hazardous during floods.

3. Acquisition of flood prone areas for use as parks, open space, wildlife habitat, and other public uses.

Potential users of the floodplain should base their land use decisions upon the advantages and disadvantages of such a location. Knowledge of flood hazards is many times not understood; consequently the managers of floodplain property, potential users, and occupants cannot always accurately assess the risks. In order for floodplain management to effectively play its role in the planning, development, and use of floodplains, it is necessary to:

1. Develop appropriate technical information and interpretations for use in floodplain management by state and local units of government.
2. Provide technical services to managers of floodplain property for community, industrial, and agricultural uses.
3. Improve basic technical knowledge about flood hazards.

A joint coordination agreement was executed between the Nebraska Natural Resources Commission (NNRC) and the U.S. Department of Agriculture, Soil Conservation Service (SCS) on November 20, 1981 to furnish technical assistance in carrying out floodplain management studies (FPMS). Authority for carrying out this study is provided by Section 6 of Public Law 83-566, Watershed Protection and Flood Prevention Act (Reference 1). This authorizes the SCS to cooperate with other federal, state, and local agencies to make investigations of the watersheds of rivers and other waterways as a basis for coordinated programs. In carrying out this study, the SCS is directed by Executive Order No. 11988, dated May 24, 1977 (Reference 2), which instructs federal agencies to provide leadership to avoid the risk of flood loss, minimize impacts of floods on people, and to restore and preserve the natural and beneficial values served by floodplains.

To reduce the degree of flooding and associated loss of lives and property, the NNRC is responsible for a non-structural program of floodplain management including the delineation of 100-year floodplains and floodways. The NNRC has adopted minimum standards for local floodplain programs and assists cities and counties in the implementation and enforcement of those programs. This responsibility is designated through the 1983 Legislative Bill 35 Floodplain Management Act (Reference 3).

The NNRC provides technical assistance to local governments and is the State Coordinating Agency for the National Flood Insurance Program.

This study is conducted in accordance with the October 1986 Plan of Work, and April 1992 Supplement to the Plan of Work, developed and endorsed by the SCS, NNRC, and Twin Platte Natural Resource District (NRD). The technical information in this FPMS was prepared by the SCS. This study shows high water profiles and areas subject to flooding based on analyses of existing stream hydraulics and current watershed and floodplain land use and cover.

Special appreciation is extended to the individuals who contributed information for the study. Appreciation is also extended to the landowners who permitted access to their property for surveys, photographs, and reconnaissance.

STUDY AREA

The Ogallala Tributaries Watershed contains approximately 39,000 acres (61 sq. mi.). The Watershed is located in Keith County, Nebraska. The study area involves portions of SCS Hydrologic Unit Areas 10190018060 and 10190018090 and all of Hydrologic Unit Areas 10190018070 and 10190018080.

Hydrologic Unit Area 101900018060 is referred to as Chase Canyon where it junctions with the South Platte River.

Hydrologic Unit Area 10190018070 is the original Ogallala Tributary PL-566 application.

Hydrologic Unit Area 10190018080 is the Cure Creek Watershed, a PL-566 project which encompasses 860 acres (1.3 sq. mi.). Cure Creek Watershed was planned in 1960. This project proposed one floodwater retarding dam which was completed in 1966.

Hydrologic Unit Area 10190018090 is referred to as Roscoe Drain.

Streams

The study area consists of 18 individual subwatersheds. The first subwatershed contains Ogallala Gulch. Ogallala Gulch has its headwaters in SE 1/4, Section 7, Township 14

North, Range 39 West. From this point Ogallala Gulch flows southeast around the west end of the east-west runway at the airport, to bridges under Highway 30 and Union Pacific Railroad in the SW 1/4, NW 1/4, Section 11, T13N, R39W to the South Platte River floodplain, three miles west of the City of Ogallala.

The second subwatershed is an unnamed tributary which has its headwaters in SE 1/4, SW 1/4, Section 27, T14N, R39W. From this point the tributary flows south to a small dam in the SE 1/4, NE 1/4, Section 3, T13N, R39W. This dam has a negligible effect on major flooding. The outflow from this dam flows into the floodplain of subwatershed 1 in the SE 1/4, Section 3, T13N, R39W.

The third subwatershed is an unnamed tributary which has its origin in the SW 1/4, NW 1/4, Section 27, T14N, R39W. From this point the tributary proceeds southeast to a small dam in the NE 1/4, NW 1/4, Section 2, T13N, R39W. This dam has little effect on any major runoff. The outflow from this dam then flows south through Larry McGinley's property, then south to the access road to the airport. From there straight south to bridges under Highway 30 and the Union Pacific Railroad in the NW 1/4, NE 1/4, Section 11, T13N, R39W.

The fourth subwatershed has an unnamed tributary which commences in the NE 1/4, SW 1/4, Section 26, T14N, R39W. This tributary flows southeast through another small dam in the NW 1/4, NW 1/4, Section 1, T13N, R39W. This dam has an insignificant effect on any flooding from the north. The outflow from this dam then flows through the old Drive-In Theater, across West Fifth Street, south on West "R" Street to Highway 30. At Highway 30 the water flows east across "Q" Street and "O" Street, and empties into the north-south channel which is the outlet for subwatershed 5 and the dam in subwatershed 6.

The fifth subwatershed has another unnamed tributary. This stream begins in the SW 1/4, SE 1/4, Section 26, T14N, R39W and flows southeast into a breached dam in the NW 1/4, NW 1/4, Section 1, T13N, R39W. From this dam it flows south across Ethel Avenue, West Fifth Street between West "N" and West "O", West Fourth Street at West "N" Street. At this intersection of West "N" and West Fourth it flows southeasterly until it reaches the channel that carries the outflow from the dam in subwatershed 6. At this point it flows south to its junction with subwatershed 4 outflow and then flows under Highway 30, the Union Pacific Railroad, and River Street.

Subwatershed 6 contains a dam in the SE 1/4, SE 1/4, Section 36, T14N, R39W. This dam was refurbished to meet

State standards for a flood protection high hazard dam in November of 1989. The inflow source to this dam begins in the NE 1/4, SW 1/4, Section 26, T14N, R39W and proceeds from there to the dam. The outflow from this dam enters the Ogallala storm sewer system, exits on the south side of West Fifth Street and flows south along the west edge of the fairgrounds. Joining the outflows of subwatersheds 4 and 5, it flows beneath Highway 30, the Union Pacific Railroad, and River Street. The runoff from the area below the dam collects along West "K" Street. It flows south along West "K" Street. At the intersection of West "K" Street and West Sixth Street it flows southwest overland crossing West Fifth Street and into the fairgrounds. It then flows south to a four-foot corrugated metal pipe which is silted closed beneath Highway 30. The water collects at this point until it overtops Highway 30 and then flows south directly across the highway and east into the Business District of Ogallala.

Subwatershed 7 includes a dam in the SE 1/4, SW 1/4, Section 31, T14N, R38W. This dam located north of the baseball field was renovated to meet State standards for a flood protection high hazard dam in November, 1989. The tributary flowing into this structure begins at the center of Section 25, T14N, R39W and flows southeast to the dam. The release from the dam flows into a culvert beneath the baseball diamond in Glines Nye Park. The culvert outlets at the intersection of West Tenth Street and West "B" Street.

The outflow from the dam and the runoff from the area below the dam flows south on West "B" Street, appropriately nicknamed Canal Street. At the intersection of West "B" Street and West Railroad Street it flows beneath the Farm Cooperative Association grain elevator. After the grain elevator, it flows beneath the Union Pacific Railroad and River Street, and finally into the South Platte River floodplain.

The runoff from the urban area between Spruce Street, or Highways 61 and 26, and East "J" Street flows south across Highway 30 to the Union Pacific Railroad. At this point this runoff along with the spillover from subwatersheds 4, 5, 6, and 7 flows east to Humphreys Pond. Humphreys Pond also receives the outflow from subwatershed 8, the Cure Creek Watershed.

Subwatershed 8 is the Cure Creek Watershed. This watershed has its upper reaches in the SW 1/4, NW 1/4, Section 30, T14N, R38W. Cure Creek then flows southeast to its floodwater retarding dam. This floodwater retarding dam is a PL-566 dam which was built in December of 1966. Within 500 feet of the outlet of this dam, it enters the storm sewer of Ogallala and exits into Humphreys Pond south of Highway 30, south of the Moose Lodge. The runoff from the area below the dam flows south on East "I" Street to Highland Drive. At the intersection of East "I" Street and

Highland Drive, the water flows east until midway between East "K" and East "M" Streets at which point it goes overland in a southeasterly direction. When the flow reaches East "M" Street, it flows directly south down the street, crosses East Sixth Street and flows overland southeast. Crossing East Fourth Street, west of the intersection of East "N" Street, it then crosses East "N" Street flowing overland past the west end of the Lazy K Motel to the ditch on the north side of Highway 30. At this ditch, it then flows straight east to its junction with the outflow of subwatershed 9, which is 600 feet east of "S" Street.

The ninth subwatershed has an unnamed tributary which commences in the NE 1/4, NE 1/4, Section 16, T14N, R39W. This tributary meanders southeast to a depression north of Highway 26. No appreciable water reaches the South Platte River from this depression for the rainfalls studied in this report. Runoff reaching the South Platte River from this drainage area, actually begins in the NE 1/4, SE 1/4, Section 19, T14N, R38W. It flows south under Highway 61, then southeast and south to a small dam in the SW 1/4, SE 1/4, Section 32, T14N, R38W. This dam is not a high hazard class dam, and therefore, has minimal effect on major storms. From this dam, the flow is southeast to Highway 30 and the junction with subwatershed 8 outflow. The combined flow from subwatersheds 8 and 9 flows east to a culvert

beneath Highway 30 at the sewage disposal sight. Once beneath Highway 30, the flow is joined by the outflow from Humphreys Pond and then goes beneath the Union Pacific Railroad to another bridge beneath East River Dale, then south to the South Platte River floodplain.

Subwatershed 10 is the furthest east and the last area to be studied north of the South Platte River. It also contains an unnamed tributary. This stream has its headwaters located in the NW 1/4, NE 1/4, Section 29, T14N, R38W. The watercourse then works its way southeast to bridges under Highway 30 and the Union Pacific Railroad in the NW 1/4, NW 1/4, Section 3, T13N, R38W and into the South Platte River floodplain.

Happy Hollow, subwatershed 11, originates in the NW 1/4, SE 1/4, Section 5, T12N, R38W. Happy Hollow flows north. Once it reaches the southeast corner of Section 8, T13N, R38W it flows parallel to the east edge of the section along the county road to a box culvert under Interstate 80 in the NE 1/4, NE 1/4, Section 8, T13N, R38W, then under an access road, to the South Platte River floodplain.

Subwatershed 12 has an unnamed tributary that begins in the SW 1/4, SE 1/4, Section 17, T13N, R38W. This stream flows north to Prospector Drive. At Prospector Drive it flows west to the west edge of Section 8, T13N, R38W.

Through culverts it flows under Prospector Drive. Then joined by flow from subwatershed 13 and also subwatershed 14, it flows straight north to box culverts beneath Interstate 80, then under an access road and on north to the floodplain of the South Platte River.

Subwatershed 13 has its origin in NE 1/4, NW 1/4, Section 20, T13N, R38W. From this point it flows northwest to the northwest corner of Section 17, T13N, R38W through two two-foot diameter corrugated metal pipes. It then flows north along the county road designated Road East "A" South. At Prospector Drive, it flows over the road joining the flow from subwatershed 14 and then the runoff from subwatershed 12.

Subwatershed 14 was divided into two separate watersheds by the elevated Highway 61. The eastern part of sub-watershed 14 originates in the SE 1/4, SW 1/4, Section 20, T13N, R38W. From there it flows northwest to the county road along the west edge of Section 20, T13N, R38W to two culverts silted shut. Water on the other side of the county road flows northwest to Highway 61, then north along Highway 61. At Prospector Drive it is joined by the runoff from the western portion of subwatershed 14. It flows under Prospector Drive and follows the road to the east where it is joined by subwatershed 13 flow. At the southeast corner

of the Union 76 property, it combines with flow from subwatershed 12 and goes north.

The west portion of subwatershed 14 begins in the NE 1/4, SW 1/4, Section 18, T13N, R38W. It flows north along Highway 61 to Pony Express Lane. At this point, it goes east beneath Highway 61 and combines with the flow from the east portion of subwatershed 14.

Subwatershed 15 was split into two watersheds. The eastern portion of subwatershed 15 begins in the NE 1/4, SE 1/4, Section 30, T13N, R38W. It flows north along Highway 61. In the SW 1/4, NE 1/4, Section 19, T13N, R38W it flows under Highway 61 and continues north. At Road West 80 it flows through three 40-inch diameter corrugated metal pipes. At Interstate 80 in the SW 1/4, NW 1/4, Section 7, T13N, R38W, it flows through box culverts to another culvert under the access road and then to the South Platte River floodplain.

The western portion of subwatershed 15 is north of Road West 80 and joins the eastern portion of subwatershed 15 at the Interstate.

Subwatershed 16 has an unnamed watercourse that has its headwaters in the SE 1/4, SW 1/4, Section 31, T13N, R38W. This stream then meanders north to the Interstate 80 box

culverts in the SW 1/4, NW 1/4, Section 12, T13N, R39W and to the South Platte River floodplain.

Subwatershed 17 begins in the SW 1/4, NE 1/4, Section 35, T13N, R39W and flows north to the Interstate 80 box culverts in the NE 1/4, SE 1/4, Section 11, T13N, R39W and then to the floodplain of the South Platte River.

Subwatershed 18 was split into two areas. An eastern and a western portion. The eastern portion of subwatershed 18 begins in SW 1/4, SW 1/4, Section 22, T13N, R38W and flows north to the northwest corner of Section 15, T13N, R38W. At this point it flows north along the county road across Prospector Drive along the Ogallala Country Club to the Interstate. Here the flow combines with the flow from the west and moves east.

The west portion of subwatershed 18 originates in the NE 1/4, SW 1/4, Section 16, T13N, R38W. It flows north to Prospector Drive through a culvert then along the Ogallala Country Club to the Interstate and overflow from subwatershed 11. At this point it moves east, combined with the runoff from the east part of subwatershed 18. It is possible to have portions of the Ogallala Country Club under water for these large floods.

TABLE 1
DETAILED STUDY AREA

<u>Subwatershed</u>	<u>Length in Miles</u>	<u>Drainage Area in Acres</u>
1 (Ogallala Gulch)	8.0	10410
2	2.5	280
3	3.7	1770
4	2.1	850
5	1.8	590
6	0.8	660
7	0.8	930
8 (Cure Creek)	0.8	880
9	1.2	3020
10	1.3	1310
11 (Happy Hollow)	5.2	4400
12	1.5	410
13	1.5	380
14	1.5	660
15	2.7	1380
16	3.7	2740
17	3.0	2630
18	<u>2.6</u>	<u>1430</u>
Total	44.7Miles	34730
Non Contributing		<u>4500</u>

39,230 Acres

61.3 sq. mi.

SOILS AND TOPOGRAPHY (Reference 4)

The watershed includes three distinct physiographic areas; a gently sloping loess tableland occupying the upland divides, an alluvial terrace area bordering the South Platte River, and a steep transition area approximately three fourths of a mile in width, separating the tableland from the alluvial terrace.

Silt and sandy loams are the predominant surface soil textures. Approximately 55 percent of the upland soils are

deep friable loess. The balance are steep shallow residual soils. The soils on the alluvial terrace are deep and have good surface drainage.

Strongly sloping to steep soils on uplands contain the Altvan-Dix complex. This complex consists of very deep, well-drained and excessively drained soils. This complex is about 50 to 70 percent Altvan soils and about 20 to 40 percent Dix soils. The Altvan soils are on side slopes that are typically less than 15 percent and are on plane or concave positions on the landscape.

The Dix soils are on narrow ridge tops and convex shaped slopes. The two soils are so intricately mixed or so small in size that it is not practical to separate them in mapping. These soils support native grasses and are used as rangeland. These soils are not suited to cultivated crops because of droughtiness of the Dix soils and steep slopes. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive. Dix is a gravelly loam. It is very deep, gently sloping to moderately steep, excessively drained soil.

On upland swales, Duroc silt loam is found. This is a very deep, nearly level, well-drained soil. It is formed in silty local colluvium and alluvium. Most of the acreage of

this soil is used for cultivated crops. A few areas are used as pastureland.

If this soil is dryland farmed, it is suited to growing wheat, corn, alfalfa and grasses. The lack of precipitation is the major limitation, although soil blowing is a slight hazard where the surface is not adequately protected by growing crops or crop residue. Some practices, such as summer fallow and stubble mulching, disking and chiseling are used to build up subsoil moisture and reduce soil blowing.

If this soil is irrigated, it is suited to corn, beans, alfalfa and grasses. Both gravity and sprinkler irrigation systems can be used. Efficient management of the irrigation water is needed. Soil blowing is a slight hazard. Practices, such as disking and chiseling help reduce the hazard of soil blowing. Returning crop residue and barnyard manure to the soil helps maintain and improve the organic matter content, fertility and soil tilth. It also increases infiltration of water.

Keith loam, also found on uplands, is a very deep, gently sloping, well-drained soil. It is formed in loess. Most all of the acreage of this soil is used for cultivated crops. A few areas are used as rangeland. As with the

Duroc soil, it is subject to water erosion and soil blowing if not adequately protected.

Kuma loam is a very deep, nearly level, well-drained soil on uplands. It formed in loess over a buried soil that also formed in loess. Areas of this unit are irregular in shape, and in some areas are large tablelands. Most all of the acreage of this soil is used for cultivated crops. Soil blowing is a slight hazard where the surface is not adequately protected.

Lodgepole silt loam is very deep, nearly level, somewhat poorly drained soil in upland potholes. It is subject to ponding. Over half of the acreage of this soil is used for dryland crops and the rest is used as pastureland. Some years when the annual rainfall is below normal, a crop can be grown. In years when there is normal to above average rainfall, this soil will be under water. Lodgepole is poorly suited to both dryland and irrigated crops because of ponding. Wetness from the seasonal ponding often delays tillage and cultivation early in the spring.

Rosebud loam is moderately deep, gently sloping and strongly sloping, well-drained soil on uplands. It formed in calcareous loamy material that weathered from soft, very fine-grained sandstone. Most of the acreage of this soil is used for cultivated crops. A few areas are used as

pastureland or rangeland. Major hazards are water erosion and soil blowing if the surface is not adequately protected by crops or crop residue.

Sarben loamy fine sand is a very deep, gently sloping, well-drained soil found on uplands. Most of the acreage of this soil is used for cultivated crops. A few areas are used as pastureland or rangeland. If Sarben soil is dryland farmed, it is poorly suited to corn, winter wheat, grasses and legumes. Soil blowing is a severe hazard and low fertility is a limitation. Water erosion is also a hazard. If irrigated by a sprinkler system, this soil is suited to corn, alfalfa, winter wheat and introduced grasses. This soil is unsuited to gravity irrigation because of the high intake rate of water and the undulating topography of the landscape. This soil is suited to range. This use is effective in controlling soil blowing.

Satanta loam is a very deep, very gently sloping, well-drained soil on uplands. Most of the acreage of this soil is used for cultivated crops. A few areas are used as pastureland or rangeland. Water erosion and soil blowing are hazards where the surface is not adequately protected. Practices, such as stubble mulching, disking and chiseling that leave crop residue on the surface help protect soil blowing and water erosion as well as conserve moisture. Terraces are used to reduce water loss during heavy rains

and to hold more moisture on the fields for crops. This soil is suited to range. This use is effective in controlling soil blowing if not overgrazed.

Satanta Dix complex consists of very deep, well-drained and excessively drained, gently sloping and strongly sloping soils on uplands. This complex is about 55 to 75 percent Satanta soils and about 20 to 40 percent Dix soils. The Satanta soils are on linear or concave side slope positions on the landscape. The Dix soils are on narrow ridge tops and convex shaped shoulder slopes. The two soils are so intricately mixed or so small in size that it is not practical to separate them in mapping. Most of the acreage of these soils is used for cropland, with dryland winter wheat being the principal crop. These soils are poorly suited as cropland, both dryland and irrigated, because of the strongly sloping slopes and droughtiness. Soil blowing and water erosion are the principal hazards. These soils are suited to range.

Vetal loamy fine sand is a very deep, nearly level and very gently sloping, well-drained soil on upland swales. Most of the acreage of this soil is used for cultivated crops. The rest is used as rangeland or pastureland. Soil blowing is a major hazard if the surface is not adequately protected by crops or crop residue.

Sully McConaughy complex consists of very deep, well-drained, moderately steep and steep soils on deeply dissected loess uplands. Water erosion is active as in evidence by the generally rilled conditions of the surface. Individual areas of this unit range from 10 to 100 acres in size and contain from 50 to 80 percent Sully soils and from 15 to 40 percent McConaughy soils. The Sully soils are on moderately steep, convex shaped slopes. The McConaughy soils are on linear or concave lower back slopes with slopes of less than 15 percent. The two soils are so intricately mixed or so small in size that it is not practical to separate them in mapping. These soils are generally unsuited to use as cropland because of the steep slopes and the severe hazard of water erosion. These areas should be reseeded to native grasses to reduce soil loss. These soils are suited to range. This use is effective in controlling soil blowing and water erosion.

Tassel-Otero-Rock outcrop complex consists of steep and very steep, somewhat excessively drained and well-drained soils and rock outcrop on dissected uplands. Individual areas of this unit range from 5 to 200 acres in size and contain from 35 to 55 percent Tassel soils, from 20 to 40 percent Otero soils and about 20 percent rock outcrop. Most of these soils support native grasses and are used as rangeland. These soils are not suited to cultivated crops because of steep slopes, the presence of shallow soils and

rock outcrop. If overgrazing continues for many years, woody plants may invade the site.

Sully loam is a very deep, well-drained, strongly sloping soil and is found on convex breaks between the smooth upland divides and the steep canyons. It formed in loess. This soil is suited to range. This use is effective in controlling soil blowing and water erosion. Overgrazing by livestock or improper haying methods reduce the protective cover and cause the native plants to deteriorate. Overgrazing also can result in soil losses by water erosion and soil blowing. Range seeding may be needed to stabilize severely eroded cropland.

On the stream terraces, Bayard very fine sandy loam can be found. Bayard is a very deep, very gently sloping, well-drained soil. It formed in colluvial alluvial sediments. This soil is suited to dry farmed winter wheat. Water erosion and soil blowing are moderate hazards if the surface is not adequately protected by crops, crop residue or terraces. Under irrigation, this soil is suited to corn, dry edible beans, and alfalfa. This soil is also suited to range and native hay. This use is effective in controlling soil blowing.

Bridget silt loam is a very deep, nearly level, well-drained soil found on stream terraces. It formed in silty

calcareous colluvial alluvial sediments. Most of the acreage of this soil is used for irrigated crops, with corn and dry edible beans being the principal crops. The rest is used as pastureland. If this soil is dryland farmed, this soil is suitable to wheat, alfalfa and grasses.

Bridget loam is a very deep, very gently sloping, well-drained soil on stream terraces. Most of the acreage of this soil is used for irrigated crops with corn and dry edible beans being the principal crops. The rest is used as pastureland.

Duroc loam is a very deep, nearly level, well-drained soil on the stream terraces of the South Platte River. It formed in silty alluvium over sand and coarse sand. Most of the acreage of this soil is used for irrigated crops. Both gravity and sprinkler systems can be used. Soil blowing is a slight hazard. A few areas are used as pastureland.

Bankard loamy sand is a very deep, somewhat excessively drained soil found on the floodplain. It formed in sandy alluvium. The soil is dissected by channels that meander back and forth across the floodplain. This soil is subject to frequent flooding. Nearly all of the acreage of this soil is used as rangeland. This soil is unsuited to farming because of the hazard of flooding and because of the high

drought potential due to low available water capacity of the soil.

LAND CAPABILITY CLASSIFICATION

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for windbreaks, and for engineering purposes.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. In the following table soils identified with an * are considered prime farmland.

TABLE 2
LAND CAPABILITY CLASS

<u>Soil</u>	<u>Dryland</u>	<u>Irrigated</u>
Altvan Dix Complex	VIe-3	
Bankard Loamy Sand	VIw-7	
*Bayard Very Fine Sandy Loam	IIe-3	IIe-8
*Bridget Silt Loam	IIC-1	I-6
*Bridget Loam	IIe-1	IIe-6
Dix Gravelly Loam	VIIs-4	
*Duroc Loam	IIC-1	I-6
*Duroc Silt Loam	IIC-1	I-6
*Keith Loam	IIIe-1	IIIe-4
*Kuma Loam	IIC-1	I-4
Lodgepole Silt Loam	IIIw-2	IVw-2
*Rosebud Loam	IVe-1	IVe-4
Sarben Loamy Fine Sand	IVe-5	IVe-10
Satanta Loam	IIe-1	IIe-4
*Satanta Dix Complex	IVe-1	IVe-4
Sully Loam.....	IVe-9	IVe-6
Sully McConaughy Complex.....	VIe-9	
Tassel-Otero Rock Outcrop Complex.....	VIIIs-4	
Vetal Loamy Fine Sand.....	IIIe-5	IIIe-10

PRIME FARMLAND

Prime farmland, as defined by USDA, is land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated, pastureland, woodland, or other land,

but it is not urban, built-up land or water areas. It either is used for food or fiber crops or is available for those crops.

The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal inputs of energy and economic resources. The farming of it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent.

CLIMATE

Winters are cold because of fairly frequent incursions of cold, continental air. Summers are hot but are marked by occasional interruptions of cooler air from the north. Snowfall is fairly frequent in winter, but the snow cover is usually not continuous. Rainfall is heaviest in late spring and early summer.

In winter the average temperature is 27 degrees Fahrenheit and the average daily minimum temperature is 13 degrees. The lowest temperature on record, which occurred at Ogallala on February 1, 1951, is -24 degrees F. In summer the average temperature is 72 degrees, and the average daily maximum temperature is 87 degrees. The highest recorded temperature, which occurred in July, 1954 is 111 degrees F.

The average annual precipitation is 18 inches. Of this, 80 percent usually falls in April through September, which includes the growing season for most crops. In two years out of ten, the rainfall in April through September is less than 10 inches. The heaviest one-day rainfall during the period of record was 3.36 inches at Ogallala on June 5, 1965. Thunderstorms occur on about 47 days each year, and most occur in summer.

Average seasonal snowfall is 29 inches. The greatest snow depth at any one time during the period of record was 18 inches. On average, one day of the year at least one inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the

time possible in summer and 60 percent in winter. The prevailing wind is from the northwest. Average wind speed is highest, 13 miles per hour, in spring.

Severe duststorms occur on occasion in spring, when strong dry winds blow over unprotected soil. Tornadoes and severe thunderstorms, some with hail, strike occasionally. These storms are local, of short duration, and result in damage patterns being variable and spotty.

GEOLOGY

Semi-consolidated sandstones, siltstones, silty sands and clayey silts of the mid-tertiary Ogallala Formation (Ash Hollow Member) comprise the bedrock of the area. These bedrock units dip slightly to the east and are often exposed in the canyons and breaks of the transition zone between uplands and floodplain.

The surficial materials in the uplands consist primarily of wind-deposited silty sands and clayey silts (loess). Canyon bottoms and the South Platte floodplain contain alluvial channel and terrace deposits. These stream-deposited materials are mostly sand and gravel with interstratified silts and clays. Thickness of the unconsolidated materials is variable but generally less than 100 feet.

SOCIAL AND ECONOMIC INFORMATION

Agriculture is a major income-generating industry in the watershed area. Tourism at Lake McConaughy is significant also but agriculture and ag-related business provide the major sources of employment. The crops grown in the watershed are wheat, corn, dry edible beans, alfalfa, soybeans, and sorghum. Approximately 70 percent of the cropland is irrigated.

The following census data (Reference 5) for years 1982, 1987, and 1992 are for all of Keith County.

Family-owned farms are predominant in Keith County, accounting for 77 percent of the farms in 1992. While the number of farms decreased nine percent over the 10-year period in Keith County, the average size of farms increased 16 percent. Between 1982 and 1992, the number of farms operated by part owners decreased by 19 percent. The number of farms operated by full owners also decreased while the number of tenants increased. The average age of farm operators has increased from 49.8 years to 52.8 years over the same period. The market value of agricultural products sold increased 38 percent between 1982 and 1992 mainly due to the increase of livestock products. During that same time period the proportion of this market value derived from

crops, decreased from 43 percent to 25 percent. In 1992, 141 operators (41 percent) reported some days of work off farm. This was 2 percent more than corresponding data for the State of Nebraska.

POPULATION (Reference 6)

Ogallala is the only incorporated town, located in the watershed. It has a population of 5,095. Of these, 4,790 are Caucasian, 194 Hispanic, 31 American Indian, 13 Asian, 6 Black and 61 are other. The rural population of the watershed is estimated to be 134 people.

HISTORICAL AND ARCHAEOLOGICAL (Reference 7)

Prior to nineteenth-century white settlement, the Pawnee and Sioux tribes claimed the land of the Sandhills as hunting grounds. The Pawnee claimed the drainage area of the Loup River as their hunting grounds, while the Sioux controlled the western Sandhills including the forks of the Platte and north to the White River in South Dakota. Both tribes depended on the bison as their primary source of food and raw material.

Nebraska was part of a vast expanse of land west of the Mississippi designated by an act of Congress as land for Native Americans. The region, however, was traveled by fur

trappers and traders, missionaries and settlers heading further west between the years of 1804 and 1854, when the territory of Nebraska was officially opened to settlement. The famous Oregon, Mormon and California Trails all passed westward along the Platte River and were used extensively between 1841 and 1848. From 1859-1869, the Overland Stage Company passed through what was to become Keith County. The area did not see any permanent settlement, however, until the Union Pacific Railroad line arrived in 1867. Ogallala came into being first as a siding and then as a depot on the Union Pacific mainline.

Nebraska became a state in 1867. Keith County was established in 1873 and was one of the earliest counties in the western section of Nebraska. In 1874, the Union Pacific Railroad built holding pens and loading chutes just west of Ogallala hoping to attract cattle shippers. Soon Ogallala became the final destination of the drovers bringing huge herds of Texas Longhorn cattle up the Chisolm and Texas trails. Ogallala soon became the ideal shipping point for Texas cattle and the second largest shipping point on the Union Pacific. The days of the Texas trail drives earned Ogallala a reputation as a roaring boom town. In 1884, more settlers began to move into Keith County and the days of the wild west began to fade into memory.

Ogallala was named for the Ogallala branch of the Teton Sioux Indians who roamed the plains west of Keith County. It was settled predominantly by persons of Irish, German, and Swedish descent. The Irish came with the railroad construction while the German and Swedish came to farm.

Only one known archaeological site presently exists (near the Plate River) within the study area. Each sub-watershed, however, may contain potentially significant cultural resources.

Different accounts also indicate a Pony Express relay station was located just south of Ogallala, however, its precise location is not known. Within the city limits of Ogallala a historically important former mill site and concrete block flour mill have been identified adjacent to the railroad. In addition, numerous potentially significant buildings exist within Ogallala.

NATURAL VALUES

Floodplains, in their natural or relatively undisturbed state, provide numerous beneficial natural resource values. These values include natural moderation of floods, water quality maintenance, and groundwater recharge. The physical characteristics of the floodplain regulate or modify flood flows.

Floodplains serve important functions in protecting the physical, biological and chemical integrity of water. Vegetation slows the surface runoff, causing it to drop most of its sediment on the floodplain. Pathogens and toxic substances entering the main water body through surface runoff and the accompanying sediments are then decreased. The surface conditions favor local ponding detention while subsurface conditions are conducive to infiltration and storage. This slowing of runoff provides additional time for the infiltration and natural purification of water while recharging available groundwater aquifers.

FORESTRY

Ogallala Tributaries contain little woodland. The limited areas which do exist are in fence rows and windbreaks or located along stream channels and bottomlands. Eastern cottonwood and peachleaf willow are the predominant

woodland species. Other associated species include sandbar willow, green ash, Russian-olive, golden currant, indigobush and eastern redcedar.

Steep north and east facing slopes in the canyons and breaks contain the eastern redcedar forest cover type. Eastern redcedar are generally lightly scattered on the slopes along with dense clumps of shrubs. Associated shrubs are skunkbush sumac, American plum, common chokecherry, golden currant, silver buffaloberry and western snowberry (white buckbrush).

Cottonwood-Willow forest cover type occupies the Platte River bottom. This riparian forest owes it's existence to availability of groundwater along the river. Eastern cottonwood and peachleaf willow are the predominant species in this woodland. Other associated species include sandbar willow, green ash, Russian-Olive, golden currant, indigo bush and eastern redcedar.

WILDLIFE

Having winter wheat, irrigated corn, and alfalfa as primary crops, habitat is provided for a variety of openland wildlife such as pheasant, prairie chicken, mule deer, cottontail rabbit and mourning dove. The shallow wetlands furnish important feeding and resting habitat for migrating

waterfowl and shore birds in the spring. The permanent water supply and density of shrubs and trees on river banks and islands provide excellent cover year-round. Waterfowl, herons, shorebirds, mink, raccoon, coyote, bobcat, wild turkey, songbirds, whitetail deer, cottontail rabbit, great horned owl and small rodents are all common.

THREATENED AND ENDANGERED SPECIES

The bottomlands along the South Platte River provide important seasonal habitat to several federally listed endangered species of wildlife including the bald eagle, least tern, piping plover, and occasionally whooping crane. The river otter, a state listed endangered species, uses this habitat type year round.

WATER QUALITY (REFERENCES 8 & 9)

Surface water flow is limited to the South Platte River within the Ogallala Watershed. Other drainage within the watershed does not have flow except during runoff events.

The Nebraska Department of Environmental Quality has classified this segment of the South Platte River as Warmwater Class A. Classification as Class A Warmwater means that these waters provide, or could provide, a habitat suitable for maintaining one or more identified key species on a year-round basis. These waters also are capable of

maintaining year-round populations of a variety of other warmwater fish and associated vertebrate and invertebrate organisms and plants.

The water is classified as Class A Agricultural. This classification means these waters can be used for general agricultural purposes such as irrigation and livestock watering without treatment. This would mean the nitrate and nitrite as nitrogen does not exceed 100 mg/l, the selenium does not exceed 0.02 mg/l, and the conductivity does not exceed 2000 umhos/cm. The water is also aesthetically acceptable meaning they are free from human induced pollution which causes noxious odors; floating, suspended, colloidal, or settleable materials that produce objectionable films, colors, turbidity, or deposits; the occurrence of undesirable or nuisance aquatic life such as algal blooms.

Groundwater quality appears to be adequate with no known contamination problems. However, there are areas within the watershed where potential impacts could occur. Site conditions most conducive to groundwater contamination from agricultural chemicals are found where large amounts of water moves through a soil and with a relatively low capacity for adsorption. These conditions generally exist where there is irrigated agriculture, depths to groundwater

are shallow, the soils are permeable, and along major rivers and streams.

GROUNDWATER

The primary groundwater aquifer under the watershed is the Ogallala Formation, with a saturated thickness in this area of between 100 and 200 feet. The Ogallala Formation aquifer, together with alluvial and channel deposits along the Platte River floodplain, are reliable sources of groundwater. The hydrologic characteristics of the layers can be complex; multiple aquifers may be present and the degree of hydraulic connection between aquifers is variable.

Depths to water on the uplands range from 50 to 300 feet. Over most of this area water lies between 150 and 250 feet. Along the narrow, steep bluffs paralleling the river valley water occurs at 100 to 150 feet and across the floodplain it generally lies less than 50 feet deep.

The ground water supply adequately meets the watershed's domestic and livestock needs. Municipal wells derive adequate supplies from valley alluviums and occasionally from the Ogallala aquifer.

The groundwater is generally of good quality although it is hard. Its potential for contamination by nitrate and

bacteria exists from the disposal of wastes and the use of agricultural fertilizers and chemicals. Areas with sandy soils and with shallow water tables are most likely to develop problems of contamination.

PROBLEMS AND OPPORTUNITIES

FLOODING

Urban flooding is a problem within the City of Ogallala. A detailed urban economic analysis was not conducted, however, there are approximately 323 buildings that could be affected by the 500-year flood event (Table 3). The area that receives the most flooding is the area between the Union Pacific Railroad tracks and U.S. Highway 30.

There is also flooding of agricultural land within the watershed. Twenty-nine farm buildings, fences, roads, and bridges can also be damaged by floodwaters. Sediment deposition is a problem during storm events. Floods occurring during the growing season inflict damage to crops in the form of siltation and standing water. In general, flood damage in the watershed occurs with the larger storms.

Land use in the floodplains consists of 1600 acres of cropland, and 320 acres of urban land. Current cropland includes 860 acres of corn, 350 acres of dry edible beans, 100 acres of alfalfa, 240 acres of wheat and 50 acres of other land. Crop and pasture damages are estimated to be \$34,860 annually. Crop and pasture damages begin with the

one half-year flood. Data regarding estimates for crop and pasture damages by subwatersheds are shown on Table 4.

TABLE 3

BUILDINGS

SUB- WATERSHED	100 YEAR FLOODPLAIN	500 YEAR FLOODPLAIN
1	4	
2	10	
3	10	
4	45	3
5	50	1
6	20	
7	71	4
8	36	6
Along tracks	38	1
12	7	4
14	8	
18	5	

Other agricultural properties located in the floodplain include 40 farmsteads, an estimated 4.4 miles of private roads, and 10 miles of fences. Total average annual damage to other agricultural property is estimated to be \$3,750.

Roads and bridges subject to damage include 15 miles of federal and state roads, 20 miles of county roads, and 27 road crossings. Damages to roads include the replacement of surface materials, the removal of sediment from the ditches and erosion of the road banks near or at the end of bridges. These damages are estimated to be \$7,500 annually.

The total average annual damages of present floodwater problems are estimated to be \$48,770 (Table 5).

Erosion and Sediment

Most of the watershed is rangeland. Cropland is concentrated on the flatter tablelands and floodplains. Sheet and rill erosion, as well as ephemeral erosion, is not a significant concern, with proper management.

Traditional gullies are not a problem on cropland. Some occur on rangeland, especially in the transition zone between tableland and floodplain. Overall, they are a minor problem.

Nearly all the soils are susceptible to soil blowing. Soil blowing is greatest during March, April and May when the winds blow mostly from the north-northwest.

Erosion of rangeland is a low to moderate problem locally. Overgrazing in some areas has increased susceptibility to erosion.

Streambank erosion is a moderately severe problem in conjunction with larger storms. Sediment deposition can be a problem both on agricultural land and downstream in the City of Ogallala during larger storm events. It occurs not

only as runoff deposition, but also as deposition from impoundment (backup from the urban stormwater system).

The quality of water can be impaired by sediment deposited within the municipal delivery system. Some associated chemical impairment can occur.

Total present average annual damages of erosion and sediment are estimated to be \$5,380. This brings the grand total of estimated present average annual damages occurring in the watershed to \$54,150 as shown on Table 5.

TABLE 4

CROP AND PASTURE FLOOD DAMAGE 1/

SUBWATER- SHED 2/	FLOOD PLAIN (AC)	PRODUCTION		DAMAGE		
		FLOOD FREE 3/	FLOODED 4/	AVERAGE ANNUAL TOTAL 5/	PER ACRE 6/	PERCENT OF FLOOD FREE 7/
1	475	\$147,860	\$131,900	\$15,960	\$34	10.8%
2	36	\$11,210	\$10,720	\$490	\$14	4.4%
3	76	\$23,660	\$23,230	\$430	\$6	1.8%
9	43	\$13,390	\$13,180	\$210	\$5	1.6%
10	6	\$1,870	\$1,730	\$140	\$23	7.5%
11	204	\$63,500	\$62,990	\$510	\$3	0.8%
12	30	\$9,340	\$9,250	\$90	\$3	1.0%
13	51	\$15,880	\$15,470	\$410	\$8	2.6%
14	66	\$20,540	\$20,240	\$300	\$5	1.5%
15	251	\$78,130	\$72,570	\$5,560	\$22	7.1%
16	158	\$49,180	\$45,390	\$3,790	\$24	7.7%
17	33	\$10,270	\$9,080	\$1,190	\$36	11.6%
18	168	\$49,920	\$44,140	\$5,780	\$34	11.6%
TOTAL	1597	\$494,750	\$459,890	\$34,860	\$22	7.0%

1/ Price Base - 1993

2/ Subwatersheds are shown in Appendix A.

3/ Composite acre value x acres in floodplain (yield x price x % in floodplain x acres in floodplain).

4/ Flood Free minus Average Annual Total.

5/ Crop and Pasture damages occurring in the flood plain as determined by ECON-2.

6/ Average Annual Total divided by Flood Plain Acres.

7/ Average Annual Total divided by Flood Free values.

May 1993

TABLE 5

ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

OGALLALA WATERSHED, NEBRASKA
(Dollars) 1/

Item	Estimated Average Annual Damage		Damage Reduction Benefit
	Without Project	With Dam in Subwatershed 1	
Floodwater			
Crop & Pasture	37,520 2/	29,820	7,700
Other Agriculture	3,750	2,980	770
Road & Bridge	7,500	5,960	1,540
Subtotal	48,770	38,760	10,010
Sediment & Erosion	5,380	3,780	1,600
TOTAL	54,150	42,540	11,610

1/ Price base 1993.

2/ Includes Effects of Downstream Crop and Pasture Damage.

May 1993

EXISTING FLOODPLAIN MANAGEMENT

Keith County, Nebraska (Reference 10) entered the Regular Program of the National Flood Insurance Program, September 27, 1985. City of Ogallala, Nebraska (Reference 11) entered the Regular Program of the National Flood Insurance Program, September 30, 1987.

The data included in this Floodplain Management Study (FPMS) is comparable to a detailed flood insurance study.

ALTERNATIVES FOR FLOODPLAIN MANAGEMENT

Floodplain management encourages land use and development which minimizes potential flood damage and, at the same time permits floodplain development which is compatible with nature and the local area needs. Floodplain management objectives include:

1. Restricting building or other development which may cause increased flood heights or velocities.
2. Protecting individuals from investments located in flood hazard areas which are subject to frequent damage and flooding.

3. Prohibiting uses which are dangerous to public health or safety in times of flood.
4. Requiring that public or private facilities that are vulnerable to floods be protected against flood damage at the time of construction.

The achievement of these objectives is possible by implementing a floodplain management program. Such a program ordinarily requires community or group action for implementation. A floodplain management program or system can be composed of a combination of land treatment, nonstructural, and structural measures. Figure 1 illustrates the relationship of these measures. Using these alternatives, several potential courses of action can be considered:

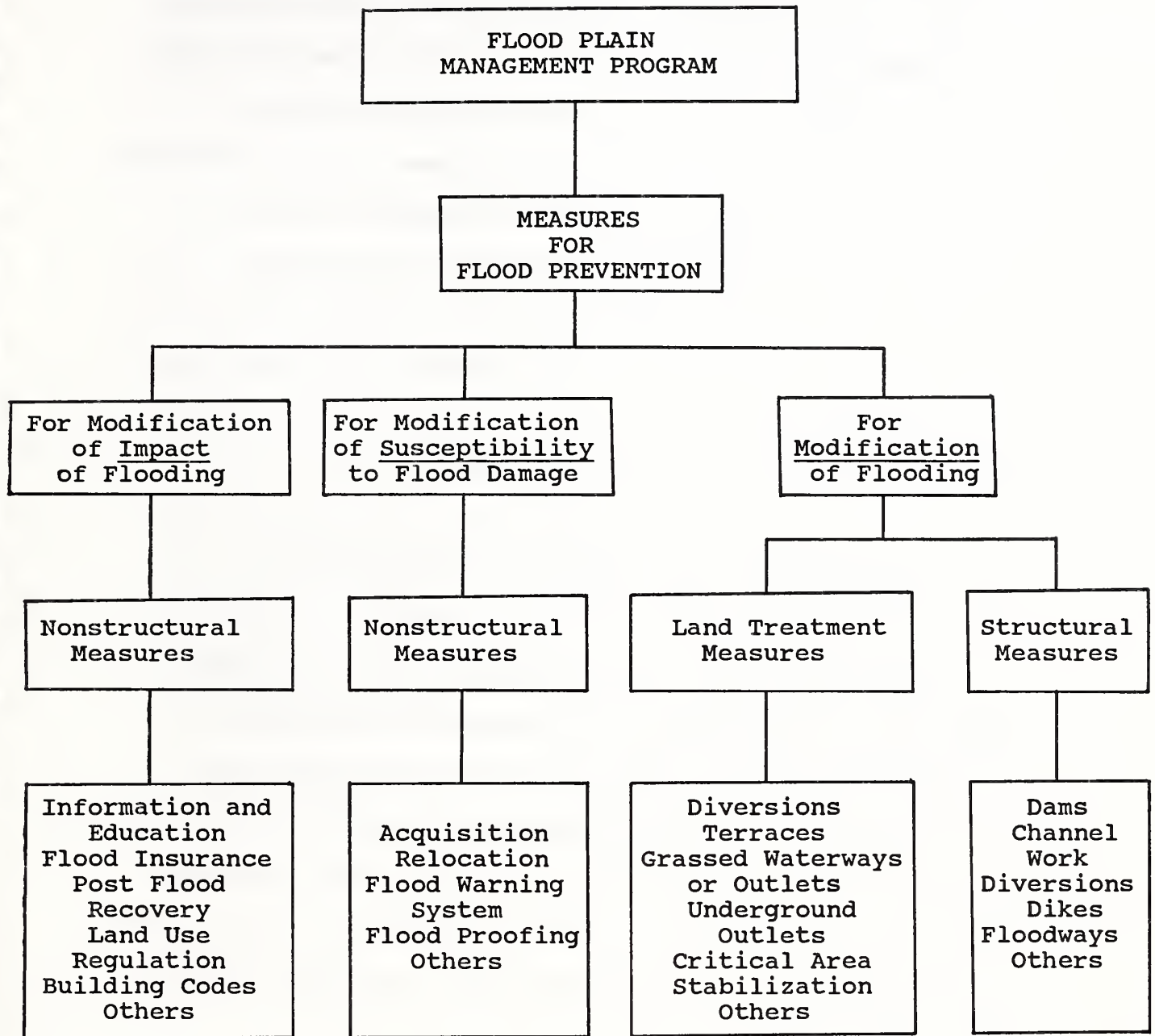
PRESENT CONDITION (No Action)

Existing problems would continue or become worse. The property owners presently subject to flooding could relocate or continue accepting flood damage.

LAND TREATMENT

Land treatment provides opportunities to reduce upland runoff and soil erosion, while improving the water quality.

FIGURE 1



The traditional approach of conservation land treatment, of working with landowners to install conservation practices, will minimize soil erosion, reduce flooding from the more frequent storms, and provide water quality benefits. Installation of such measures as terraces, grassed waterways or underground outlets, diversions, permanent vegetative cover, improved pastureland management, conservation tillage, and on site water storage will reduce runoff, erosion, and sedimentation. This approach provides excellent water quality benefits. However, it will have minimal effects on large rainfall events.

PRESERVATION AND/OR RESTORATION OF NATURAL VALUES

Since the primary value of the Ogallala Tributaries floodplains is its ability to transport floodwaters, encroachment onto the floodplains with obstacles which interfere with floodwater movement should be avoided. The floodplain areas should be maintained as parks, baseball fields and other traditional park facilities. These parks would insure an open floodplain which would not interfere with floodwater movement.

The floodplain is biologically important because it is the place where land and water meet, where elements of both terrestrial and aquatic ecosystems mix. Shading of the stream by floodplain vegetation moderates water temperature;

roots and fallen trees provide instream habitat; and near stream vegetation filters runoff, removing harmful sediments and buffering pollutants to further enhance instream environments.

The preservation of open space areas in accordance with soil limitation and good land use management will reduce development hazards and prevent additional future flood damages.

Soils with high water tables should be retained in natural vegetation. The Soil Conservation Service has completed the soil survey for Keith County and publication is scheduled (Reference 4). Copies of the material, including maps and interpretations, are available for reference in the local Soil Conservation Service Office. This information can be used to determine soil types in a given area and their limitations for various uses.

NONSTRUCTURAL MEASURES

Nonstructural measures such as land use and control regulations (zoning), building codes, flood insurance, post flood recovery are primarily administrative actions. These actions may be needed to reduce the impact of flooding, especially in areas which may be subjected to future development pressures. Nonstructural measures to reduce the susceptibility to flooding include 1) relocation of existing floodplain properties, 2) flood warning system, and 3) flood proofing.

Zoning is a legal method used to implement and enforce the details of the floodplain management program, to preserve property values, and to achieve the most appropriate and beneficial use of available land. Clear, concise, and thorough zoning bylaws with enforcement of the bylaws are essential to making zoning effective.

Building codes set up minimum standards for controlling the design, construction, and quality of materials used in buildings and structures within a given area. They provide safety for life, health, property and public welfare. Building codes can be used to minimize structural and subsequent damages resulting from inundation.

Flood insurance was established by the National Flood Insurance Act of 1968 Public Law 90-448, as amended (Reference 12) to make limited amounts of flood insurance, which were previously unavailable from private insurers, available to property owners and occupiers. The Flood Disaster Protection Act of 1973, Public Law 93-234, as amended, (Reference 13) was a major expansion of the National Flood Insurance Program.

Flood insurance is available through local insurance agents and brokers only after a local governing body applies and is declared eligible for the program by the Federal Insurance and Hazard Mitigation Division of the Federal Emergency Management Agency (FEMA). Adoption and enforcement of a local floodplain management ordinance, which meets FEMA and State minimum floodplain management criteria, is necessary to qualify and maintain eligibility.

In those communities participating in the FEMA program, owners and occupiers of all buildings and mobile homes in the entire community are eligible to obtain flood insurance coverage. Where flood insurance is available, it is recommended that buildings and mobile homes within or adjacent to the delineated flood hazard areas carry flood insurance on the structure and contents.

Development policies designed to prevent construction of streets and utility systems in flood prone areas will limit development of the floodplains.

Emergency preparedness consists of a plan by local officials to be put into effect in the event of flooding. Procedures are worked out and personnel designated to implement the plan. The emergency preparedness plan would describe methods and procedures to alert and warn the populous of possible flooding. High risk areas, and individuals who are handicapped, elderly or others known to need help during evacuation are located and identified. Plans are made for their evacuation or rescue. Shelters are provided for evacuees.

Relocation of existing floodplain properties is intended to reposition residential, commercial, industrial, and farm buildings on flood free land. Land that is evacuated for relocation should have a restriction in the deed or other recorded restrictions to prohibit rebuilding on that land. Such lands could be used for parks or other purposes that would not be subject to large flood damages and would not interfere with flood flows.

Flood Warning Systems are used to notify floodplain occupants of potential flooding in time to protect property from damage, to evacuate the area, or both. These warnings

can be initiated by 1) The National Weather Service which issues frequent warnings of potential flood producing storms; 2) Staff gauges, which are set at key locations and monitored to give advance warnings; and 3) A float-activated electronic signal which is connected to the local police or fire station for monitoring. An effective forecasting and warning system must be supported by an emergency action plan.

Flood Proofing consists of work on individual buildings such as blocking of low level entrances and windows, installing one way valves in drains, strengthening walls and foundation, installing protective walls, and elevating the building or contents above the base flood (1% recurrence interval) elevation to minimize flood losses.

STRUCTURAL MEASURES

Structural measures are installed to provide reduction in damages from flooding, erosion, and sediment deposition. These damages occur to cropland, pastureland, roads, bridges, urban areas, public and private utilities. Structural measures may also be installed for multiple purposes such as recreation, fish and wildlife enhancement, municipal water supply and other uses. Measures considered for this watershed included dams, levees, floodways and

channel modification. These measures were studied but none were economically feasible under the PL-566 program.

COMBINATION OF ALTERNATIVES

Some future floodplain management programs which appear applicable for Ogallala Tributaries Watershed, Nebraska follow:

Alternative 1 - No Action

Components: This alternative would consist of continuing participation in the Regular Program of the National Flood Insurance Program. However, the floodplain studied by FEMA was the floodplain of the South Platte River. It did not include the floodplains of the 18 individual subwatersheds.

Effects: New development in the South Platte River floodplain will be regulated and flood insurance will continue to be available to cover structures and their contents for flood losses. New development in the floodplains of the 18 separate subwatersheds would not necessarily be regulated.

Alternative 2 - Land Treatment

Components: This alternative consists of land treatment measures.

Effects: Land treatment would reduce erosion and sediment from upland areas and from further transport to road ditches in Ogallala. This would in turn reduce maintenance required on road right-of-ways and other sediment deposition areas. As was previously stated, land treatment will have minimal effects on large rainfall events. However, by reducing sediment deposition from the more frequent events, the channel and or road ditch capacity is not reduced. More of the runoff for the larger storms will be kept in the channels.

Alternative 3 - Structural

Investigations were made of the hydrology and economics of the watershed and some potential dam sites. During the course of the investigations, it became apparent that much of the flooding in the City of Ogallala can be eliminated by increasing culvert sizes, removing blockages, and cleaning the main drains west of the city. Additional dams would not produce enough benefits to be economically feasible.

Costs for dams in subwatersheds 1, 3, 4, 5, and 9 were computed (Table 6). A dam west of Ogallala in subwatershed 1, Ogallala Gulch, appeared to have potential to reduce rural flooding and was economically analyzed. Based on this information and preliminary design criteria, this dam could not be economically justified by SCS criteria (Table 7). No other dams were economically analyzed.

The floodwater retarding dam proposed for Ogallala Gulch in subwatershed 1 was put into a watershed model. Having the dam in the model, there would be a 21 percent reduction in damages for the rural areas. Table 5 gives the comparison of average annual damages and benefits for the dam.

Social effects would be minor as the dam would neither isolate nor alter the general surroundings of landscape to any great extent. During construction traffic could be affected temporarily.

Benefits from the reduction of flood damages are calculated by finding the difference between damages without project and damages with the project. The benefits are estimated to be \$11,610 as shown on Table 5.

Cost analysis includes the calculation of installation costs and annual operation, maintenance and repair costs.

The installation costs include the cost of the dam, engineering services, contingencies, project administration, and land rights. High hazard dam criteria was used for the calculation of construction costs. Total installation costs are estimated to be \$428,850 as shown on Table 6.

Final project economic feasibility is determined by listing all the costs and benefits in the year they occur, showing their cash flow and calculating the internal rate of return on investment. This rate of return is less than one-half percent as shown on Table 7.

TABLE 6

ESTIMATED COST DISTRIBUTION
OF SUBWATERSHEDS WITH DAMSOGALLALA WATERSHED, NEBRASKA
(Dollars) 1/

Subwatershed No. Install	Construc- tion	Engineering Services	Land Rights	Project 2/	Total Adm. Costs
1	344,000	75,000	9,380	470	428,850
3	155,000	34,000	4,250	210	193,460
4	109,000	24,000	3,000	150	136,150
5	101,000	22,000	2,750	140	125,890
9	187,000	41,000	5,200	260	233,460
TOTAL	896,000	196,000	24,580	1,230	1,117,810

1/ Price base 1993

May 1993

2/ Cost of modifying utilities not included.

TABLE 7

CASH FLOW AND RATE OF RETURN
FOR DAM IN SUBWATERSHED 1
OGALLALA WATERSHED, NE
1993 Dollars

Year	Eng.	Capital Items	O.M.&R. Cost	Gross Costs	Gross Benefit	Increm. Cash Flow	Accum. Cash Flow
1	30000	141540	0	171540	0	-171540	-171540
2	45000	212310	690	258000	4640	-253360	-424900
3			1720	1720	11600	9880	-415020
4			1720	1720	11600	9880	-405140
5			1720	1720	11600	9880	-395260
6			1720	1720	11600	9880	-385380
7			1720	1720	11600	9880	-375500
8			1720	1720	11600	9880	-365620
9			1720	1720	11600	9880	-355740
10-45			61920	61920	417600	355680	-60
46			1720	1720	11600	9880	9820
47			1720	1720	11600	9880	19700
48			1720	1720	11600	9880	29580
49			1720	1720	11600	9880	39460
50			1720	1720	11600	9880	49340
TOTAL	75000	353850	83250	512100	561440	49340	
Rate of Return =							0.4499%

May 1993

An alternative that should be addressed immediately is culvert sizing. The watercourse west of the fairgrounds and east of West "O" Street needs a change in the culverts. At US Highway 30, for this drain, there is a bridge that has an opening that is 30 feet wide and six feet high. At the Union Pacific Railroad, the opening is 55 feet wide and five feet high. At River Street, the opening is a four-foot diameter concrete culvert. This is a reduction in flow area of 170 square feet. This causes water to be backed up to West Fourth Street. By enlarging the opening under River Street to 30 feet by six feet, and improving the channel south of this opening, it reduces the depth of flow north of US Highway 30 by two feet. Also, this reduction in flow depth would eliminate forcing this water east along the north side of US Highway 30 as currently occurs (Table 8).

A culvert under US Highway 30, which is the outlet for water trapped in the fairgrounds, is silted shut. It appears the culvert was once a four-foot corrugated metal pipe. This keeps water, for the large events, ponded north of US Highway 30 until it overflows to the east. For the more frequent storms, the water is trapped north of US Highway 30 until it evaporates and seeps away. The culvert should be replaced and maintained.

The water that flows south on West "B" Street, appropriately nick-named Canal Street, flows under the grain

elevator in a seven by nine foot box culvert. It then flows under the Union Pacific Railroad in a four by 20 foot box culvert. After that it flows under River Street in a five-foot diameter corrugated metal pipe. This is a reduction in flow area of 40 square feet. This forces water to back up to the north as far as US Highway 30. Having a proper size culvert under River Street, and improving the channel south of River Street, can reduce depths of flow and also reduces the amount of water that is forced east (see Table 9).

Removing the fence along the Interstate 80 north of the Union 76, or at least opening up the fence on the south end and on the east end of a drainage ditch along the Interstate, would allow the water to flow at lower depths. The water depth north of Prospector Drive would be as much as one and one-half feet lower. The rate at which the water would get away would still be dependent upon the maintenance of the channel along the east edge of the Union 76 property (see Table 10).

TABLE 8

IMPROVED AREA 5 OUTLET

OGALLALA FLOOD PLAIN MANAGEMENT STUDY

SECTION NAME	FLOOD FREQUENCY								
	500 YEAR	100 YEAR	50 YEAR	25 YEAR	10 YEAR	5 YEAR	2 YEAR	1 YEAR	0.5 YEAR
ELEVATION									
OLD									
515 HW	3220.1	3220.0	3220.0	3219.9	3219.8	3219.8	3217.4	3215.1	3213.5
IMPROVED									
515 HW	3216.4	3216.0	3215.6	3215.3	3214.8	3214.7	3213.8	3213.1	3212.7
OLD									
516 HW	3220.2	3220.1	3220.0	3220.0	3219.9	3219.8	3217.5	3215.1	3213.7
IMPROVED									
516 HW	3216.6	3216.2	3215.9	3215.5	3215.0	3214.9	3214.0	3213.3	3212.8
OLD									
517 HW	3220.5	3220.4	3220.3	3220.2	3220.0	3320.0	3218.4	3217.5	3216.3
IMPROVED									
517 HW	3218.2	3217.9	3217.7	3217.3	3217.0	3216.9	3216.3	3216.0	3215.6
OLD									
523 HW	3224.1	3224.0	3223.4	3223.2	3222.9	3222.5	3221.7	3221.0	3220.6
IMPROVED									
523 HW	3223.4	3223.0	3222.8	3222.7	3222.4	3221.9	3221.3	3220.8	3220.5

TABLE 9

IMPROVED AREA 7 OUTLET

OGALLALA FLOODPLAIN MANAGEMENT STUDY

SECTION NAME	FLOOD FREQUENCY								
	500 YEAR	100 YEAR	50 YEAR	25 YEAR	10 YEAR	5 YEAR	2 YEAR	1 YEAR	0.5 YEAR
ELEVATION									
OLD									
715 HW	3213.4	3213.3	3213.3	3213.3	3213.2	3212.6	3211.6	3209.7	3208.5
IMPROVED									
715 HW	3213.4	3213.2	3213.1	3212.8	3211.6	3210.7	3209.9	3208.8	3208.5
OLD									
716 HW	3214.9	3214.3	3214.1	3214.1	3213.5	3213.0	3212.3	3211.2	3210.4
IMPROVED									
716 HW	3214.6	3214.1	3213.8	3213.4	3212.4	3211.6	3211.2	3210.5	3210.2
OLD									
717	3215.0	3214.5	3214.3	3214.3	3213.9	3213.8	3213.6	3213.5	3213.3
IMPROVED									
717	3214.8	3214.5	3214.3	3214.1	3213.9	3213.8	3213.6	3213.4	3213.3

TABLE 10

IMPROVED AREA 14 OUTLET

OGALLALA FLOOD PLAIN MANAGEMENT STUDY

SECTION NAME	FLOOD FREQUENCY								
	500 YEAR	100 YEAR	50 YEAR	25 YEAR	10 YEAR	5 YEAR	2 YEAR	1 YEAR	0.5 YEAR
ELEVATION									
OLD									
1420 HW	3210.4	3209.9	3209.7	3209.4	3209.0	3208.6	3208.1	3207.5	3206.9
IMPROVED									
1420 HW	3209.4	3209.0	3208.8	3208.6	3208.3	3207.9	3207.4	3206.8	3206.2
OLD									
1419	3211.3	3211.0	3210.8	3210.6	3210.2	3209.8	3209.1	3208.3	3207.4
IMPROVED									
1419	3209.7	3209.3	3209.1	3208.9	3208.6	3208.2	3207.7	3207.1	3206.4
OLD									
1418 HW	3212.1	3211.7	3211.5	3211.3	3210.9	3210.3	3209.5	3208.5	3207.5
IMPROVED									
1418 HW	3210.2	3209.8	3209.6	3209.4	3209.1	3208.7	3208.1	3207.4	3206.6
OLD									
1417	3212.3	3211.9	3211.8	3211.6	3211.2	3210.7	3209.8	3208.7	3207.6
IMPROVED									
1417	3210.8	3210.4	3210.3	3210.1	3209.7	3209.4	3208.8	3208.0	3207.2
OLD									
1416 HW	3212.6	3212.2	3212.1	3211.9	3211.5	3211.0	3210.1	3208.9	3207.7
IMPROVED									
1416 HW	3211.4	3211.0	3210.9	3210.6	3210.3	3209.9	3209.2	3208.3	3207.4
OLD									
1415	3212.7	3212.3	3212.1	3211.9	3211.6	3211.1	3210.3	3209.2	3208.2
IMPROVED									
1415	3211.6	3211.2	3211.1	3210.9	3210.7	3210.4	3209.8	3209.0	3208.0

TABLE 10 (CONTINUED)

IMPROVED AREA 14 OUTLET

OGALLALA FLOOD PLAIN MANAGEMENT STUDY

SECTION NAME	FLOOD FREQUENCY								
	500 YEAR	100 YEAR	50 YEAR	25 YEAR	10 YEAR	5 YEAR	2 YEAR	1 YEAR	0.5 YEAR
ELEVATION									
OLD									
147 HW	3216.4	3214.9	3214.4	3213.9	3213.1	3212.2	3211.2	3210.5	3209.5
IMPROVED									
147 HW	3215.5	3214.3	3213.8	3213.5	3212.8	3212.2	3211.2	3210.4	3209.5
OLD									
1413	3216.4	3214.9	3214.4	3213.9	3213.1	3212.3	3211.2	3210.5	3209.6
IMPROVED									
1413	3215.5	3214.3	3213.8	3213.5	3212.8	3212.2	3211.2	3210.4	3209.6
OLD									
145E	3226.8	3226.5	3226.4	3226.2	3226.1	3225.8	3225.4	3224.8	3224.3
IMPROVED									
145E	3226.7	3226.5	3226.3	3226.2	3226.1	3225.8	3225.4	3224.8	3224.3

The existing water course for subwatershed 12 flows north to Prospector Drive, turns west and crosses Prospector Drive through four corrugated metal pipes east of Road East "A" South. The water flows north at this point into the channel east of the Union 76 Station and then beneath the Interstate highway 80.

An analysis of installing a 42-inch corrugated metal pipe was made where the water flows north to Prospector Drive. Along with a corrugated metal pipe, a channel would need to be constructed north to the drainage ditch along I-80. The water from this channel would then flow east to the concrete box culverts beneath the Interstate.

The effect of this culvert and channel is shown in Table 11. This culvert would help reduce the frequent flooding in the area of the Union 76. It should be noted that the benefit for this construction is mainly in the lower discharges. It would not totally eliminate the flooding from the larger storms which occur less frequently.

Alternative 4 - Combination of Alternatives 2 and 3

This would be the best alternative. Any work done on the culvert sizing and channel improvement would be enhanced by land treatment. The land treatment would extend the life of the changed culverts and improved channels.

TABLE 11

IMPROVED AREA 12 OUTLET

OGALLALA FLOOD PLAIN MANAGEMENT STUDY

SECTION NAME	FLOOD FREQUENCY								
	500 YEAR	100 YEAR	50 YEAR	25 YEAR	10 YEAR	5 YEAR	2 YEAR	1 YEAR	0.5 YEAR
ELEVATION									
OLD									
1310 HW	3208.2	3207.4	3207.2	3207.0	3206.6	3206.2	3205.6	3205.1	3204.4
IMPROVED									
1310 HW	3208.0	3207.0	3206.8	3206.5	3206.1	3205.5	3204.6	3204.4	3204.0
OLD									
139	3208.3	3207.7	3207.5	3207.3	3206.9	3206.5	3205.8	3205.3	3204.5
IMPROVED									
139	3208.1	3207.4	3207.1	3206.8	3206.4	3205.8	3204.8	3204.5	3204.1
OLD									
138	3209.0	3208.7	3208.5	3208.2	3207.9	3207.5	3207.1	3206.7	3206.2
IMPROVED									
138	3208.8	3208.2	3208.0	3207.7	3207.3	3207.0	3206.3	3206.1	3206.0
OLD									
127 HW	3210.8	3210.0	3209.8	3209.5	3209.1	3208.6	3208.0	3207.4	3206.4
IMPROVED									
127 HW	3209.9	3209.1	3208.8	3208.5	3208.1	3207.7	3206.8	3206.4	3206.1
OLD									
1216	3210.9	3210.3	3210.1	3209.8	3209.4	3209.0	3208.3	3207.7	3206.6
IMPROVED									
1216	3210.2	3209.4	3209.1	3208.8	3208.4	3208.0	3206.9	3206.5	3206.2
OLD									
1215 HW	3211.1	3210.6	3210.4	3210.2	3210.2	3210.1	3209.0	3208.0	3206.7
IMPROVED									
1215 HW	3210.4	3210.2	3210.1	3210.1	3209.4	3208.3	3207.0	3206.7	3206.3

TABLE 11 (continued)

IMPROVED AREA 12 OUTLET

OGALLALA FLOOD PLAIN MANAGEMENT STUDY

SECTION NAME	FLOOD FREQUENCY								
	500 YEAR	100 YEAR	50 YEAR	25 YEAR	10 YEAR	5 YEAR	2 YEAR	1 YEAR	0.5 YEAR
ELEVATION									
OLD									
1214	3211.1	3210.6	3210.4	3210.2	3210.2	3210.1	3209.0	3208.1	3206.9
IMPROVED									
1214	3210.4	3210.2	3210.1	3210.1	3209.4	3208.4	3207.2	3206.8	3206.4
OLD									
1213 HW	3211.1	3210.6	3210.4	3210.3	3210.2	3210.1	3209.0	3208.2	3207.0
IMPROVED									
1213 HW	3210.4	3210.2	3210.2	3210.1	3209.4	3208.5	3207.5	3207.0	3206.5
OLD									
1212	3211.1	3210.6	3210.4	3210.3	3210.2	3210.1	3209.0	3208.3	3207.1
IMPROVED									
1212	3210.4	3210.2	3210.2	3210.1	3209.4	3208.5	3207.6	3207.1	3206.6
OLD									
1211 HW	3211.2	3210.8	3210.6	3210.5	3210.4	3210.3	3209.8	3209.1	3208.3
IMPROVED									
1211 HW	3210.6	3210.4	3210.3	3210.3	3209.9	3209.4	3208.5	3208.3	3207.9
OLD									
1210	3211.3	3210.9	3210.7	3210.6	3210.5	3210.4	3210.2	3210.0	3209.2
IMPROVED									
1210	3210.7	3210.5	3210.5	3210.4	3210.2	3210.2	3209.7	3209.1	3208.7
OLD									
129 HW	3211.3	3211.0	3210.8	3210.7	3210.6	3210.5	3210.4	3210.2	3209.6
IMPROVED									
129 HW	3211.0	3210.7	3210.6	3210.5	3210.4	3210.3	3210.0	3209.5	3208.9
OLD									
128	3212.5	3212.3	3212.3	3212.2	3212.1	3211.8	3211.4	3211.0	3210.2
IMPROVED									
128	3212.3	3212.2	3212.1	3211.9	3211.6	3211.2	3210.4	3210.1	3209.7

FLOOD HAZARD MAPS

The Sheet Index Map (Appendix A) shows the stream reach covered by each of the Flood Hazard Maps. The Sheet Index Map also shows the subwatershed boundaries and stream reaches studied.

The limits of the 0.2 percent and 1 percent recurrence interval floods were delineated on Flood Hazard Maps (Appendix A) to indicate the extent of area inundated. The flood lines shown are based on field surveys of roads, bridges, valley sections, and interpretation of aerial photographs. These maps should only be used to determine the approximate boundaries of the flood areas. Actual dimensions measured on the ground may vary slightly from those shown on the topographic maps of this report due to map scale and reproduction limitations. The water surface profiles (Appendix B) for the 0.2, 1, 2, and 4 percent floods should be used to determine actual on-the-ground dimensions.

To determine expected flood levels at a specific location, use the Sheet Index (Appendix A). Refer to the appropriate Flood Hazard Map (Appendix A) to determine the location of the nearest surveyed section and the general area affected. Refer to the adjacent plotted water surface profiles (Appendix B) to determine the mean sea level flood

elevations for that location. Profile elevations (Appendix C) may also be used to determine the extent or depth of flooding in any given area by use of detailed field surveys.

In cases where the 0.2 and 1 percent flood boundaries are close together only the 1 percent boundary has been shown.

Flood elevations in this report are minimum elevations. Debris may collect at bridges and culverts and clog the channels during major floods and increase the depth of flooding. Analyses were made without showing the effects of potential obstructions. Also, extremely rare events such as catastrophic storms, beyond the 0.2 percent storm, were not analyzed.

GLOSSARY

Backwater -- The resulting high water surface upstream from a dam, bridge or other obstruction in a floodplain.

Basin -- An area which has its runoff collect at a common point.

Channel -- A natural stream that conveys water; a ditch or trench excavated for the flow of water.

Channel Bottom -- The elevation of the deepest part of a stream channel, the tale, at a particular cross section.

Confluence -- A flowing together or place of junction of two or more streams.

Cross section or valley section -- A graph showing the shape of the streambed, banks and adjacent land on either side made by plotting elevation at measured distances along a line perpendicular to the flow of the stream.

Datum -- An assumed reference plain from which elevations and depths are measured such as from mean sea level.

Elevation-Discharge Relationship -- The relationship between water surface elevation and rate of flow at a specified location for a range of flow rates.

Encroachment -- Obstruction in part of a floodplain which reduces floodwater carrying capacity, therefore increasing flood stages.

Flood -- An overflow of water on to land not normally covered by water. This inundation of land is temporary, and the land is normally adjacent to a river or stream, lake, or other body of water. Normally, a "flood" is considered as any temporary rise in stream flow or stage that causes a significant adverse effect. Adverse effects would be damage to property, sewer backup, creation of unsanitary conditions, sedimentation, accumulation of debris, or other problems.

Flood Peak -- The maximum instantaneous discharge of flow in cubic feet per second passing a given location. It usually occurs at or near the time of the flood crest.

Floodplain -- The relatively flat area or low lands covered by floodwaters adjacent to a watercourse such as a river or stream.

Flood Routing -- The process of determining progressively the timing and shape of a flood wave at successive points along a stream. This procedure is used to derive a downstream hydrograph from an upstream hydrograph. Local inflow and tributary hydrographs are considered.

Floodway -- The portion of the floodplain including the channel of the stream that is required for the conveyance of flood flow. The limits of the floodway are those limits where the extent of permitted encroachment would not raise the level of the 1% frequency flood more than one foot.

Flood Fringe -- The area of the 1 percent frequency floodplain lying outside of the floodway.

Head Loss -- The effect of obstructions, such as narrow bridge openings, dams or buildings that limit the area through which water must flow, resulting in an increase in depth of flow upstream from the obstruction. The difference in the flow depths upstream and downstream of the obstruction.

Headwater -- The tributaries and upper reaches which are the sources of the stream.

High Water Mark (HWM) -- The maximum observed and recorded height or elevation that floodwater reached during a storm, usually associated with the flood peak. The high water mark may be referenced to a particular building, bridge, or other landmark, or based on debris deposits on bridges, fences, or other evidence of the flood.

Hydraulics -- The science of the laws governing the motion of water and their practical applications.

Hydrograph -- A graph denoting the discharge over a period of time.

Hydrology -- The science dealing with the occurrence and movement of water upon and beneath the land areas of the earth.

Inundation -- The flooding or overflow of an area with water.

Left Bank -- The bank on the left side of a river, stream or water course, when oriented downstream.

Low Bank -- The highest elevation of a specific channel cross section at which the water will be contained without overflowing onto adjacent floodplain areas.

Low Ground -- The highest elevation at a specific stream channel cross section at which the flow in the stream can be contained in the channel without overflowing into adjacent overbank areas.

Manning's "n" -- A coefficient of channel and overbank roughness used in Manning's open channel flow formula, commonly called a retardance factor.

Reach Length -- A longitudinal length of stream channel selected for use in hydraulic or other computations.

Recurrence Interval -- The average interval of time within which the given flood will be equaled or exceeded once. A flood having a recurrence interval of 10 years is one that has a 10 percent chance of recurring in a year. Likewise, a 50-year flood has a 2 percent chance, and a 100-year flood has a 1 percent chance, of recurring in any year.

Right Bank -- The bank on the right side of the river, stream or watercourse, when oriented downstream.

Runoff -- That portion of the precipitation on a drainage area that is discharged from the area in stream channels: types include surface runoff, groundwater runoff, or seepage.

Surcharge -- Increase in depth of floodwaters in floodway.

Time of Concentration -- Time required for water to flow from the most remote point of a watershed to the outlet or other point of reference.

Water Surface Profile -- A graph showing the relationship of water surface elevation to stream channel location for a specific flood event.

Watershed -- A drainage basin or area which collects runoff and transmits it usually by means of streams and tributaries to the outlet of the basin.

Watershed Boundary -- The divide separating one drainage basin from another.

0.2 Percent Chance Flood -- A flood that has a 0.2 percent probability of occurring in any given year. This storm is classified as an extreme event, but it is not impossible. It is often referred to as the 500-year flood. It has an average frequency of occurrence in the order of once in 500 years, although the flood may occur in any given year or even in successive years.

1 Percent Chance Flood -- This event is often referred to as the 100-year flood. Contrary to popular belief, the 100-year flood is not defined as "a flood occurring once every 100 years". The 100-year flood is properly defined as, "a flood having a 1 percent probability of occurring in any given year". Thus, it is more properly referred to as a "1 percent frequency flood", although the term "100-year flood", is more popular. Statistically the 1 percent flood has an average frequency of occurrence in the order of once in 100 years, although the flood may occur in any given year or even in successive years. The 1 percent flood magnitude is based on statistical analysis of stream flow records available for the watershed and analysis of rainfall and runoff characteristics in a general region of the watershed. For these reasons, the magnitude of the 1 percent flood is different for every watershed and even different areas of the same watershed.

2 Percent Chance Flood -- This event is often referred to as the 50-year flood. A flood that has a 2 percent probability of occurring in any given year. It is more properly referred to as a "2 percent frequency flood", although the term "50-year flood" is more popular. Statistically the 2 percent flood has an average frequency of occurrence in the order of once in

50 years, although the flood may occur in any given year or even in successive years.

4 Percent Chance Flood -- This event is often referred to as the 25-year flood. This flood has a 4 percent probability of occurring in any given year. It is more properly referred to as a "4 percent frequency flood", although the term "25-year flood" is more popular. Statistically the 4 percent flood has an average frequency of occurrence in the order of once in 25 years, although the flood may occur in any given year or even in successive years.

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A P P E N D I X A

F L O O D H A Z A R D M A P S





LEGEND

- 100 Year Flood Elevation
- 500 Year Flood Hazard Area
- 134— Cross Section Location

Soil Conservation Service
Water Resource Planning Staff
Floodplain Delineation - 1994

Nebraska Natural Resource Commission
Topography Mapped - 1988

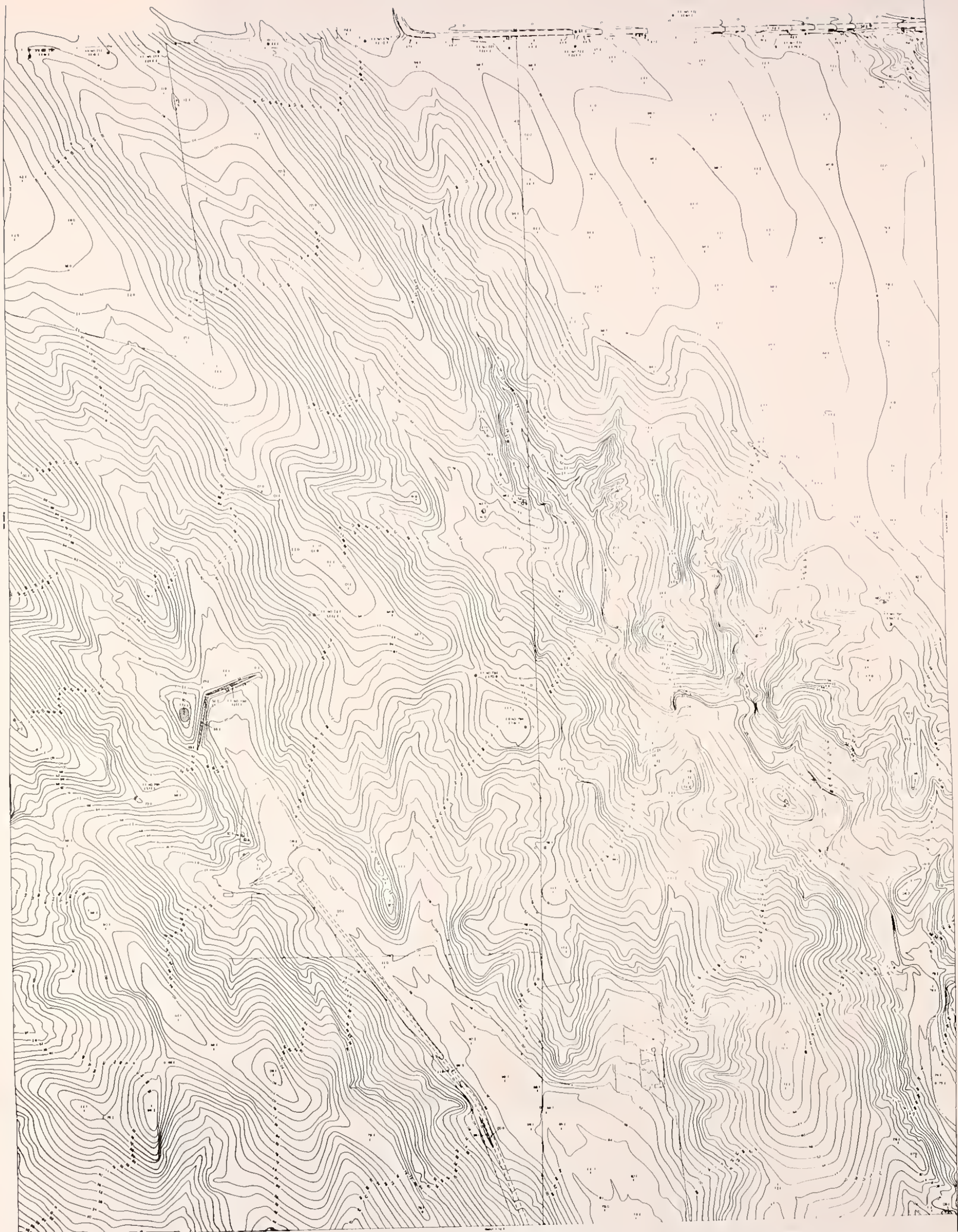
SCALE



SHEET 1 OF 25

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
**OGALLALA TRIBUTARIES
FLOOD PLAIN MANAGEMENT STUDY
KEITH COUNTY
NEBRASKA**

FLOOD PLAIN MANAGEMENT STUDY
OGALLALA TRIBUTARIES



LEGEND

— 100 Year Flood Elevation

— 500 Year Flood Hazard Area 134 — Cross Section Location

Soil Conservation Service
Water Resource Planning Staff
Floodplain Delineation - 1994

Nebraska Natural Resource Commission
Topography Mapped - 1988

SCALE

0 1 2 3 4 500
FEET



SHEET 2 OF 25

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
**OGALLALA TRIBUTARIES
FLOOD PLAIN MANAGEMENT STUDY
KEITH COUNTY
NEBRASKA**

FLOOD PLAIN MANAGEMENT STUDY

OGALLALA TRIBUTARIES



LEGEND

- 100 Year Flood Elevation
- 500 Year Flood Hazard Area
- 134 — Cross Section Location

Soil Conservation Service
Water Resource Planning Staff
Floodplain Delineation - 1994

Nebraska Natural Resource Commission
Topography Mapped - 1988

SCALE



SHEET 3 OF 25

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
**OGALLALA TRIBUTARIES
FLOOD PLAIN MANAGEMENT STUDY
KEITH COUNTY
NEBRASKA**

FLOOD PLAIN MANAGEMENT STUDY

OGALLALA TRIBUTARIES



LEGEND

- 100 Year Flood Elevation
- 500 Year Flood Hazard Area
- 134 — Cross Section Location

Soil Conservation Service
Water Resource Planning Staff
Floodplain Delineation - 1994

Nebreske Naturel Resource Commision
Topogrephy Mepped - 1988

SCALE



SHEET 4 OF 25

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
**OGALLALA TRIBUTARIES
FLOOD PLAIN MANAGEMENT STUDY
KEITH COUNTY
NEBRASKA**

FLOOD PLAIN MANAGEMENT STUDY

OGALLALA TRIBUTARIES



LEGEND

- 100 Year Flood Elevation
—— 500 Year Flood Hazard Area 134—— Cross Section Location

Soil Conservation Service
Water Resource Planning Staff
Floodplain Delineation - 1994

Nebraska Natural Resource Commission
Topography Mepped - 1988

SCALE

0 1 2 3 4 500
FEET

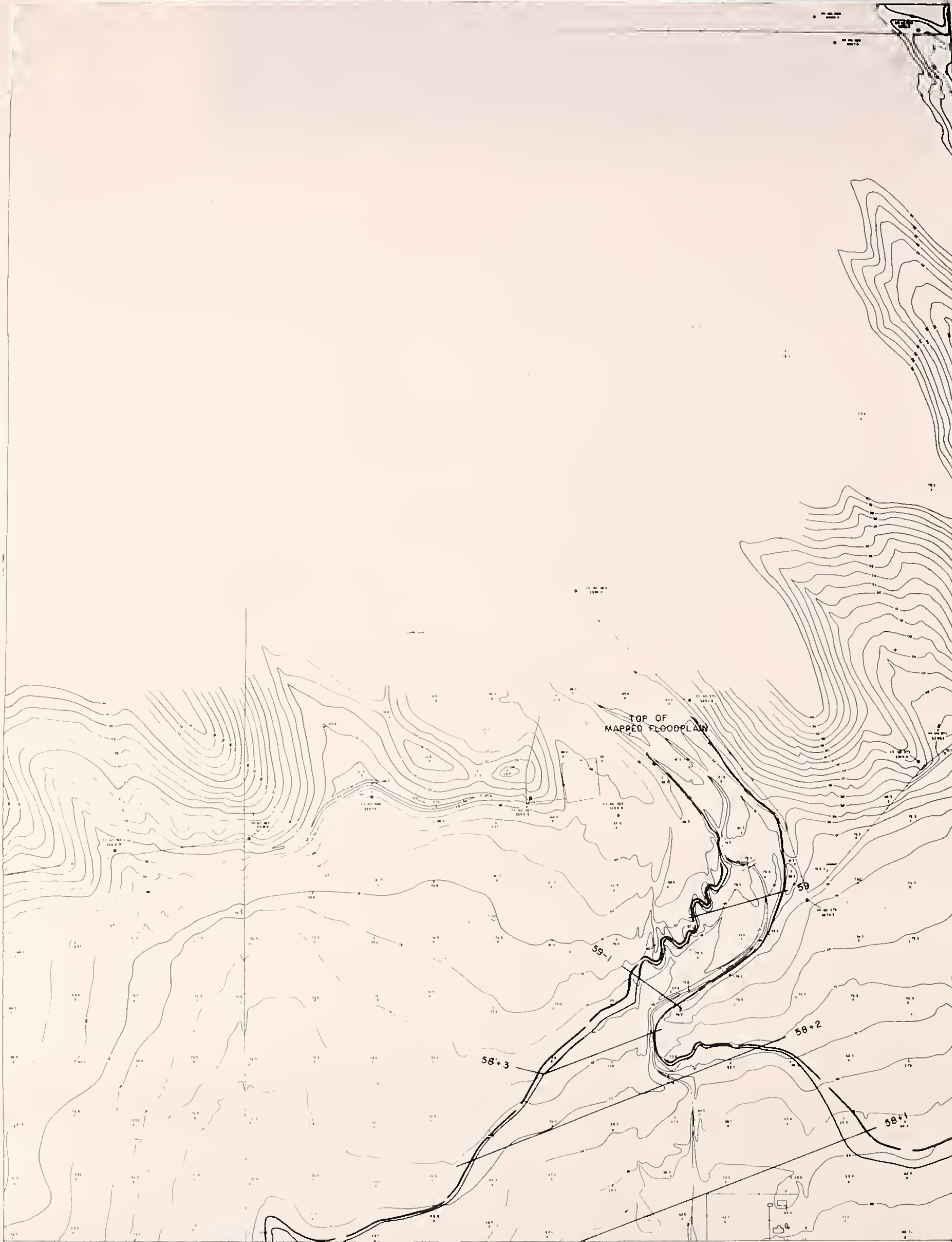


SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE

**OGALLALA TRIBUTARIES
FLOOD PLAIN MANAGEMENT STUDY
KEITH COUNTY
NEBRASKA**

FLOOD PLAIN MANAGEMENT STUDY

OGALLALA TRIBUTARIES



LEGEND

- 100 Year Flood Elevation
- 500 Year Flood Hazard Area
- 134—— Cross Section Location

Soil Conservation Service
Water Resource Planning Staff
Floodplain Delineation - 1994

Nebraska Natural Resource Commission
Topography Mapped - 1988

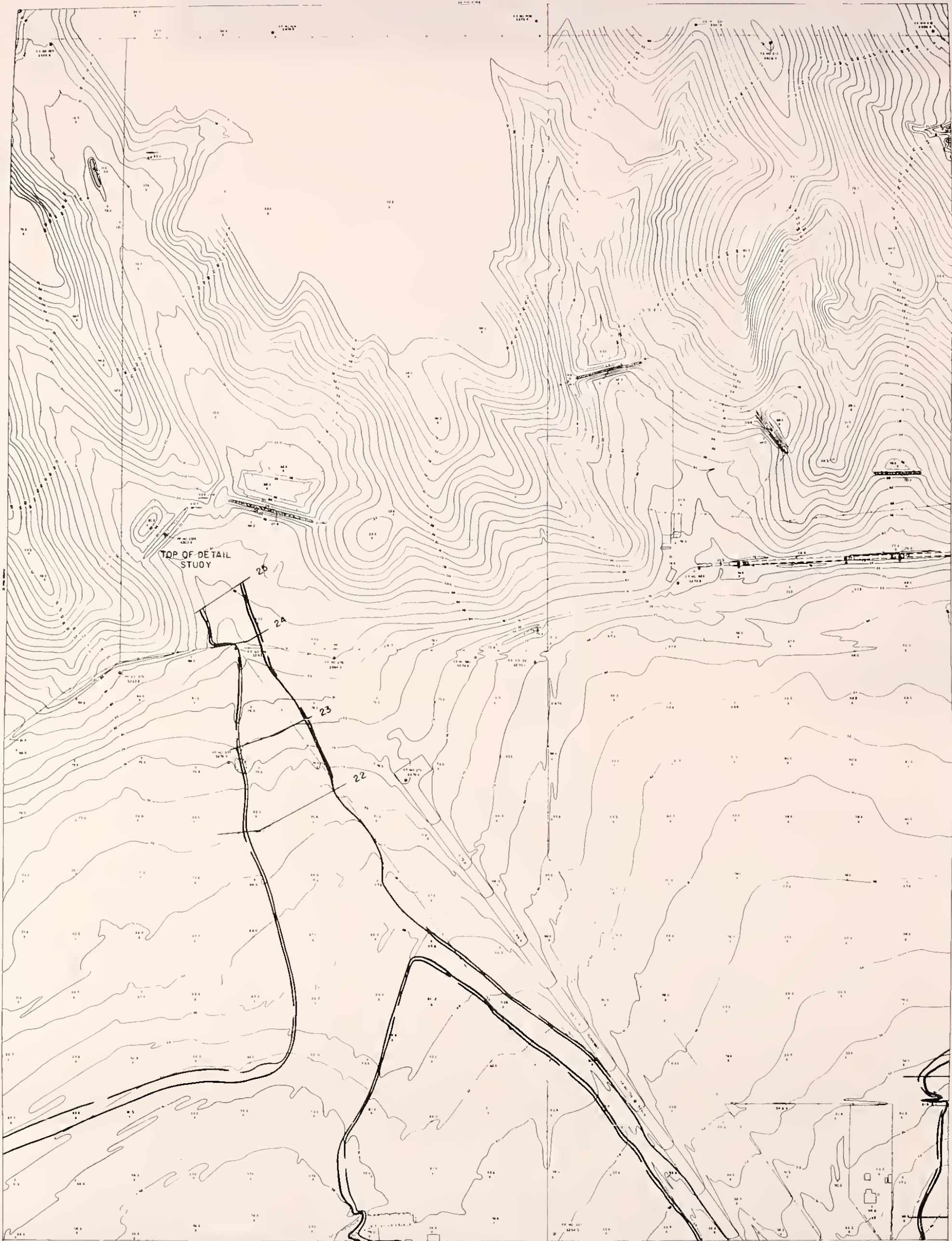
SCALE



SHEET 6 OF 25

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
**OGALLALA TRIBUTARIES
FLOOD PLAIN MANAGEMENT STUDY
KEITH COUNTY
NEBRASKA**

**FLOOD PLAIN MANAGEMENT STUDY
OGALLALA TRIBUTARIES**



LEGEND

— 100 Year Flood Elevation

— 500 Year Flood Hazard Area

134— Cross Section Location

Soil Conservation Service
Water Resource Planning Staff
Floodplain Delineation - 1994

Nebraska Natural Resource Commission
Topography Mapped - 1988

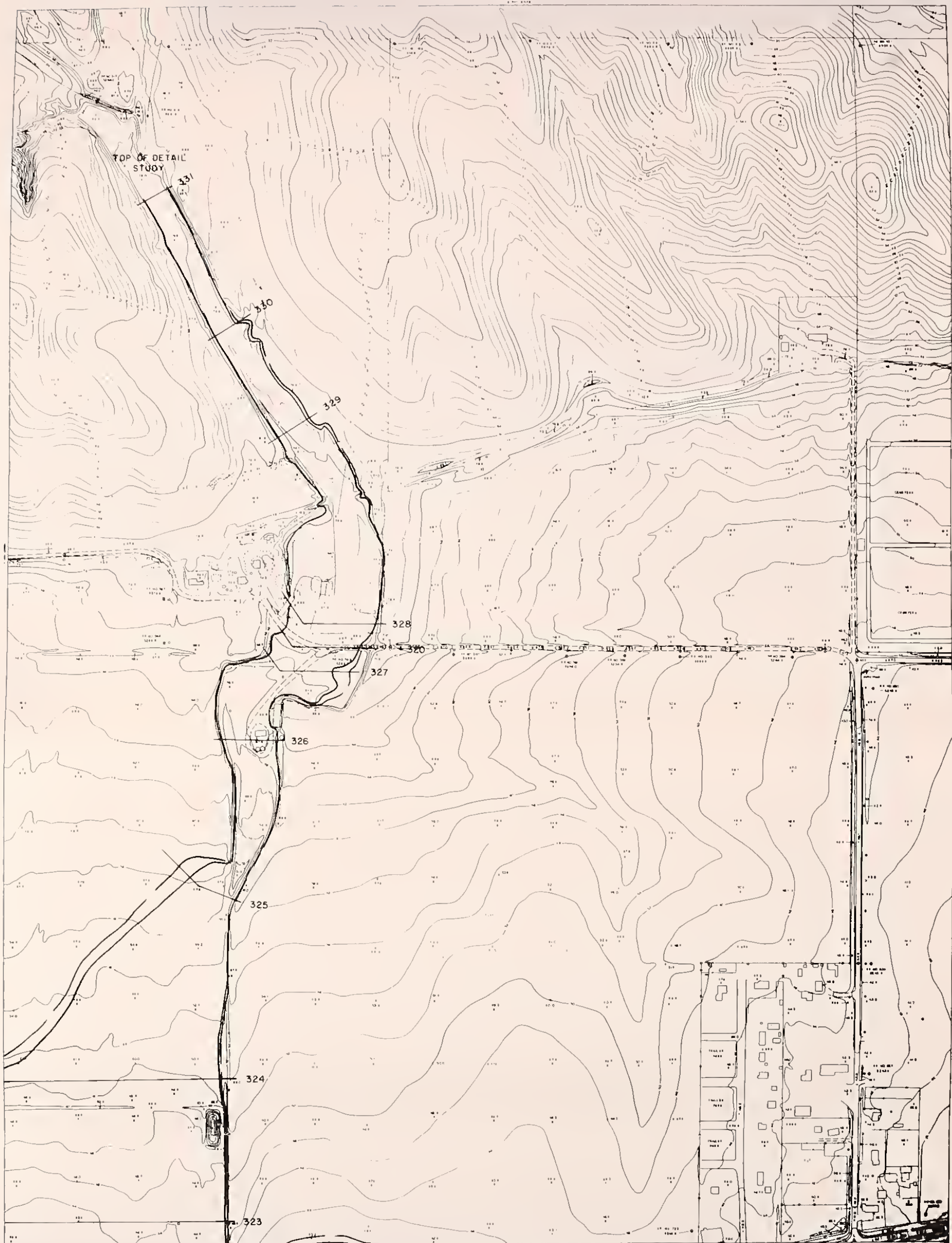
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FEET

SHEET 7 OF 25

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
**OGALLALA TRIBUTARIES
FLOOD PLAIN MANAGEMENT STUDY
KEITH COUNTY
NEBRASKA**

**FLOOD PLAIN MANAGEMENT STUDY
OGALLALA TRIBUTARIES**



LEGEND

- 100 Year Flood Elevation
- 500 Year Flood Hazard Area
- 134 — Cross Section Location

Soil Conservation Service
Water Resource Planning Staff
Floodplain Delineation - 1994

Nebraska Natural Resource Commission
Topography Mapped - 1988

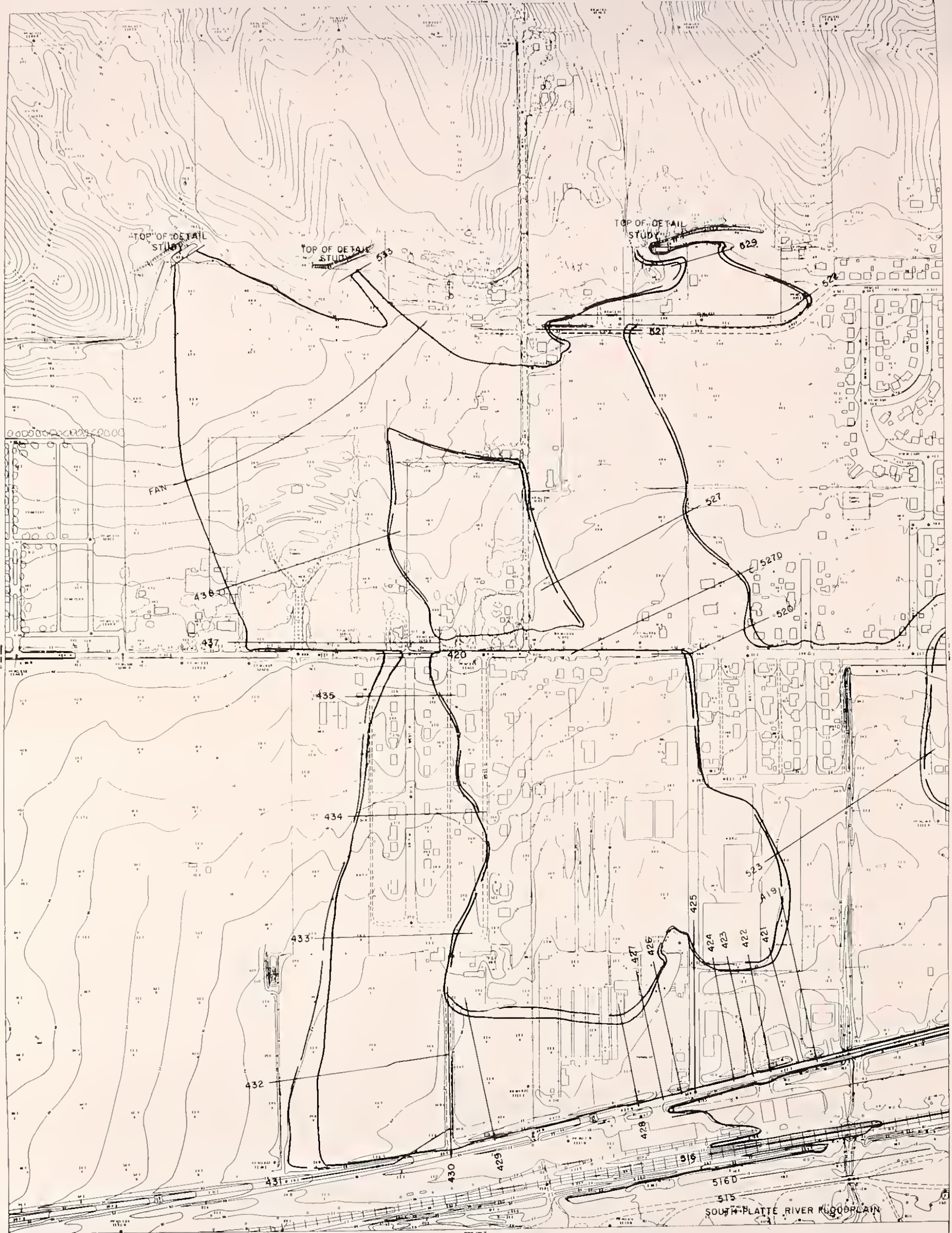
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FEET

SHEET 8 OF 25

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
**OGALLALA TRIBUTARIES
FLOOD PLAIN MANAGEMENT STUDY
KEITH COUNTY
NEBRASKA**

**FLOOD PLAIN MANAGEMENT STUDY
OGALLALA TRIBUTARIES**



LEGEND

- 100 Year Flood Elevation
- 500 Year Flood Hazard Area
- 134 — Cross Section Location

Soil Conservation Service
Water Resource Planning Staff
Floodplain Delineation - 1994
Nebraska Natural Resource Commission
Topography Mapped - 1988

SCALE

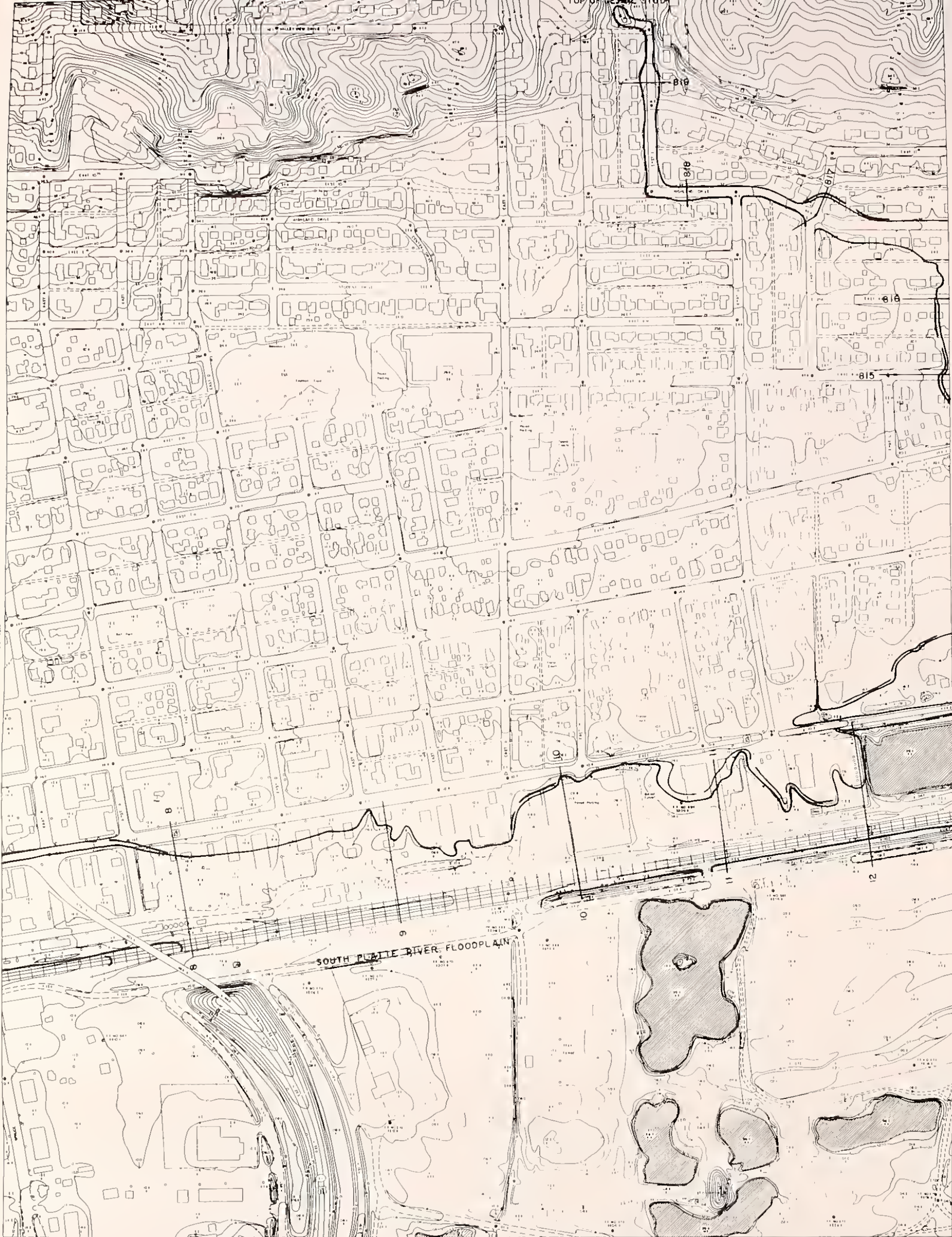


SHEET 9 OF 26

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
**OGALLALA TRIBUTARIES
FLOOD PLAIN MANAGEMENT STUDY
KEITH COUNTY
NEBRASKA**

**FLOOD PLAIN MANAGEMENT STUDY
OGALLALA TRIBUTARIES**





LEGEND

—— 100 Year Flood Elevation

—— 500 Year Flood Hazard Area

134 — Cross Section Location

Soil Conservation Service
Water Resource Planning Staff
Floodplain Delineation - 1994

Nebraska Natural Resource Commission
Topography Mapped - 1988

SCALE

0 1 2 3 4 500
FEET

SHEET 11 OF 25	SOIL CONSERVATION SERVICE U.S. DEPARTMENT OF AGRICULTURE	FLOOD PLAIN MANAGEMENT STUDY OGALLALA TRIBUTARIES
	OGALLALA TRIBUTARIES FLOOD PLAIN MANAGEMENT STUDY KEITH COUNTY NEBRASKA	



LEGEND

- 100 Year Flood Elevation
- 500 Year Flood Hazard Area
- 134— Cross Section Location

Soil Conservation Service
Water Resource Planning Staff
Floodplain Delineation - 1994
Nebraska Natural Resource Commission
Topography Mapped - 1988

SCALE



SHEET 12 OF 25

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
**OGALLALA TRIBUTARIES
FLOOD PLAIN MANAGEMENT STUDY
KEITH COUNTY
NEBRASKA**

**FLOOD PLAIN MANAGEMENT STUDY
OGALLALA TRIBUTARIES**



LEGEND

- 100 Year Flood Elevation
- 500 Year Flood Hazard Area
- 134 — Cross Section Location

Soil Conservation Service
Water Resource Planning Staff
Floodplain Delineation - 1994

Nebraska Natural Resource Commission
Topography Mapped - 1988

SCALE

0 1 2 3 4 500
FEET

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
**OGALLALA TRIBUTARIES
FLOOD PLAIN MANAGEMENT STUDY
KEITH COUNTY
NEBRASKA**

FLOOD PLAIN MANAGEMENT STUDY OGALLALA TRIBUTARIES

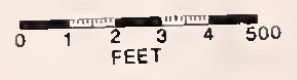


LEGEND

- 100 Year Flood Elevation
- 500 Year Flood Hazard Area
- 134 — Cross Section Location

Soil Conservation Service
Water Resource Planning Staff
Floodplain Delineation - 1994
Nebraska Natural Resource Commission
Topography Mapped - 1988

SCALE



SHEET 15 OF 25

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
**OGALLALA TRIBUTARIES
FLOOD PLAIN MANAGEMENT STUDY
KEITH COUNTY
NEBRASKA**

**FLOOD PLAIN MANAGEMENT STUDY
OGALLALA TRIBUTARIES**



LEGEND

- 100 Year Flood Elevation
- 500 Year Flood Hazard Area
- 134 — Cross Section Location

Soil Conservation Service
Water Resource Planning Staff
Floodplain Delineation - 1994
Nebraska Natural Resource Commission
Topography Mapped - 1988

SCALE

0 1 2 3 4 500
FEET

SHEET 16 OF 25

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
**OGALLALA TRIBUTARIES
FLOOD PLAIN MANAGEMENT STUDY
KEITH COUNTY
NEBRASKA**

FLOOD PLAIN MANAGEMENT STUDY OGALLALA TRIBUTARIES



LEGEND

- 100 Year Flood Elevation
- 500 Year Flood Hazard Area
- 134 — Cross Section Location

Soil Conservation Service
Water Resource Planning Staff
Floodplain Delineation - 1994
Nebraska Natural Resource Commission
Topography Mapped - 1988

SCALE

0 1 2 3 4 500
FEET

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
**OGALLALA TRIBUTARIES
FLOOD PLAIN MANAGEMENT STUDY
KEITH COUNTY
NEBRASKA**

FLOOD PLAIN MANAGEMENT STUDY OGALLALA TRIBUTARIES



LEGEND

- 100 Year Flood Elevation
- 500 Year Flood Hazard Area
- 134 — Cross Section Location

Soil Conservation Service
Water Resource Planning Staff
Floodplain Delineation - 1994
Nebraska Natural Resource Commission
Topography Mapped - 1988

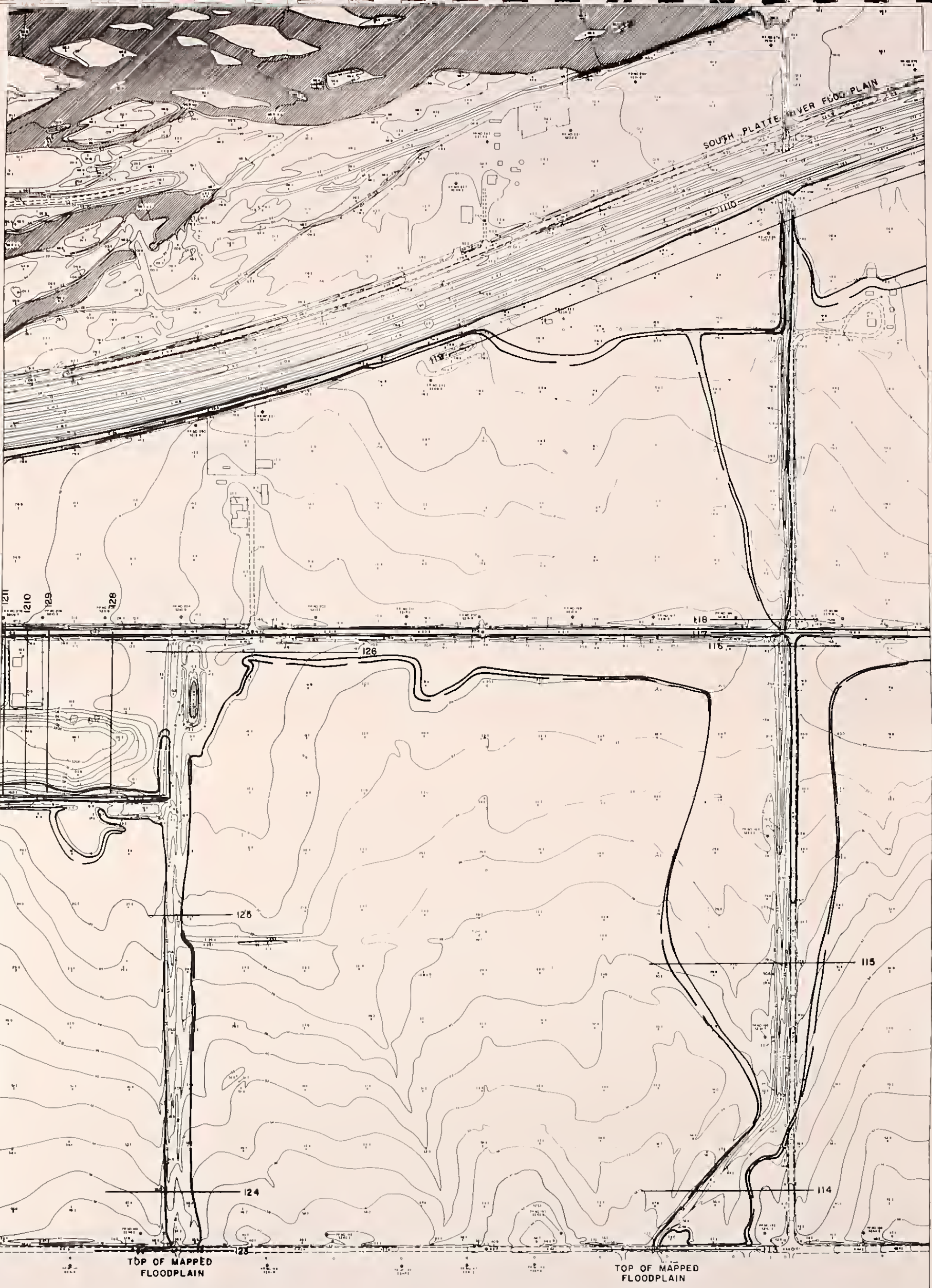
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SHEET 18 OF 25

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
**OGALLALA TRIBUTARIES
FLOOD PLAIN MANAGEMENT STUDY
KEITH COUNTY
NEBRASKA**

**FLOOD PLAIN MANAGEMENT STUDY
OGALLALA TRIBUTARIES**



LEGEND

- 100 Year Flood Elevation
- 500 Year Flood Hazard Area
- 134 — Cross Section Location

Soil Conservation Service
Water Resource Planning Staff
Floodplain delineation - 1994
Nebraska Natural Resource Commission
Topography Mapped - 1988

SCALE



SHEET 19 OF 25

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
**OGALLALA TRIBUTARIES
FLOOD PLAIN MANAGEMENT STUDY
KEITH COUNTY
NEBRASKA**

**FLOOD PLAIN MANAGEMENT STUDY
OGALLALA TRIBUTARIES**



LEGEND

- 100 Year Flood Elevation
- 500 Year Flood Hazard Area
- 134 — Cross Section Location

Soil Conservation Service
Water Resource Planning Staff
Floodplain Delineation - 1994
Nebraska Natural Resource Commission
Topography Mapped - 1988

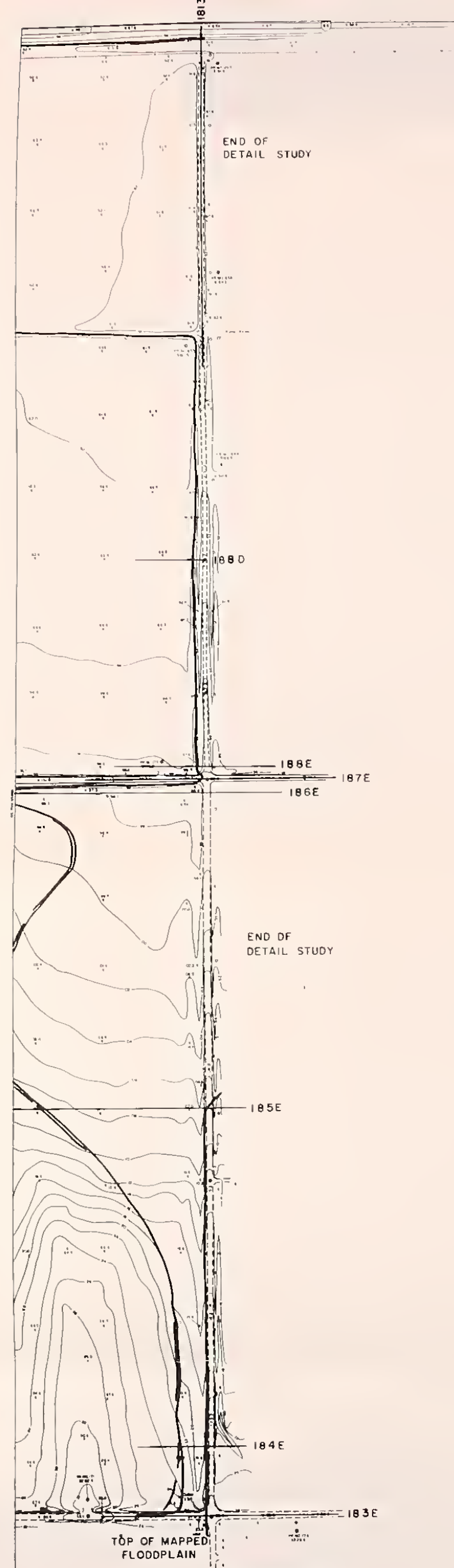
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SHEET 20 OF 25

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
**OGALLALA TRIBUTARIES
FLOOD PLAIN MANAGEMENT STUDY
KEITH COUNTY
NEBRASKA**

**FLOOD PLAIN MANAGEMENT STUDY
OGALLALA TRIBUTARIES**



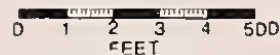
LEGEND

- 100 Year Flood Elevation
- - - 500 Year Flood Hazard Area
- 134 — Cross Section Location

Soil Conservation Service
Water Resource Planning Staff
Floodplain Delineation - 1994

Nebraska Natural Resource Commission
Topography Mapped - 1988

SCALE



SHEET 1 OF 21

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
**OGALLALA TRIBUTARIES
FLOOD PLAIN MANAGEMENT STUDY
KEITH COUNTY
NEBRASKA**

**FLOOD PLAIN MANAGEMENT STUDY
OGALLALA TRIBUTARIES**

TOP OF DETAIL STUDY

LEGEND

- 100 Year Flood Elevation
—— 500 Year Flood Hazard Area 134—— Cross Section Location

Soil Conservation Service
Water Resource Planning Staff
Floodplain Delineation - 1994

Nebraska Natural Resource Commission
Topography Mapped - 1988

SCALE

0 1 2 3 4 500
FEET



SHEET 22 OF 25

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
**OGALLALA TRIBUTARIES
FLOOD PLAIN MANAGEMENT STUDY
KEITH COUNTY
NEBRASKA**

FLOOD PLAIN MANAGEMENT STUDY

OGALLALA TRIBUTARIES



LEGEND

- 100 Year Flood Elevation
- 500 Year Flood Hazard Area
- 134 — Cross Section Location

Soil Conservation Service
Water Resource Planning Staff
Floodplain Delineation - 1994

Nebraska Natural Resource Commission
Topography Mapped - 1988

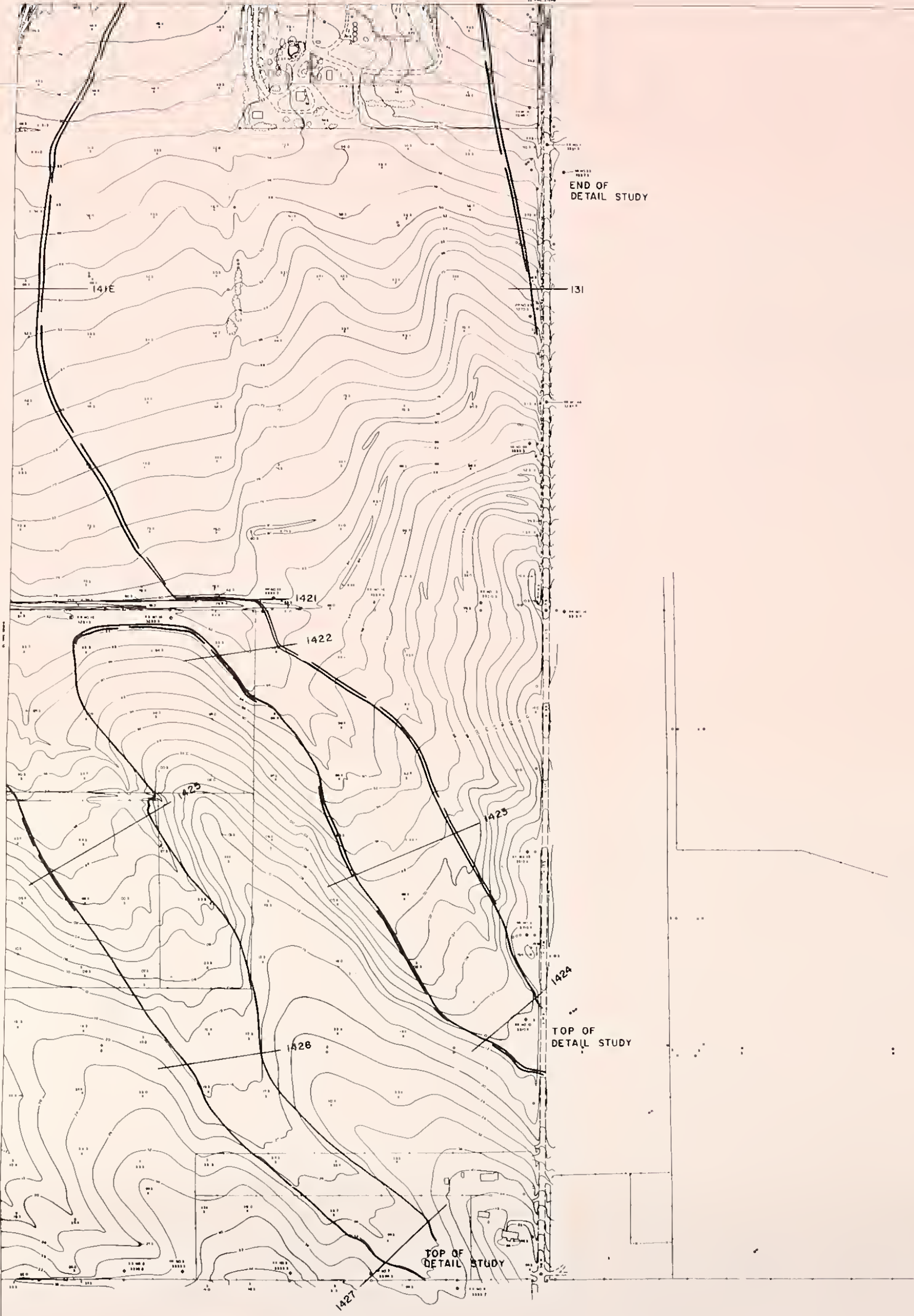
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SHEET 23 OF 25

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
**OGALLALA TRIBUTARIES
FLOOD PLAIN MANAGEMENT STUDY
KEITH COUNTY
NEBRASKA**

FLOOD PLAIN MANAGEMENT STUDY OGALLALA TRIBUTARIES



LEGEND

- 100 Year Flood Elevation
- - - 500 Year Flood Hazard Area
- 134 — Cross Section Location

Soil Conservation Service
Water Resource Planning Staff
Floodplain Delineation - 1994
Nebraska Natural Resource Commission
Topography Mapped - 1988

SCALE



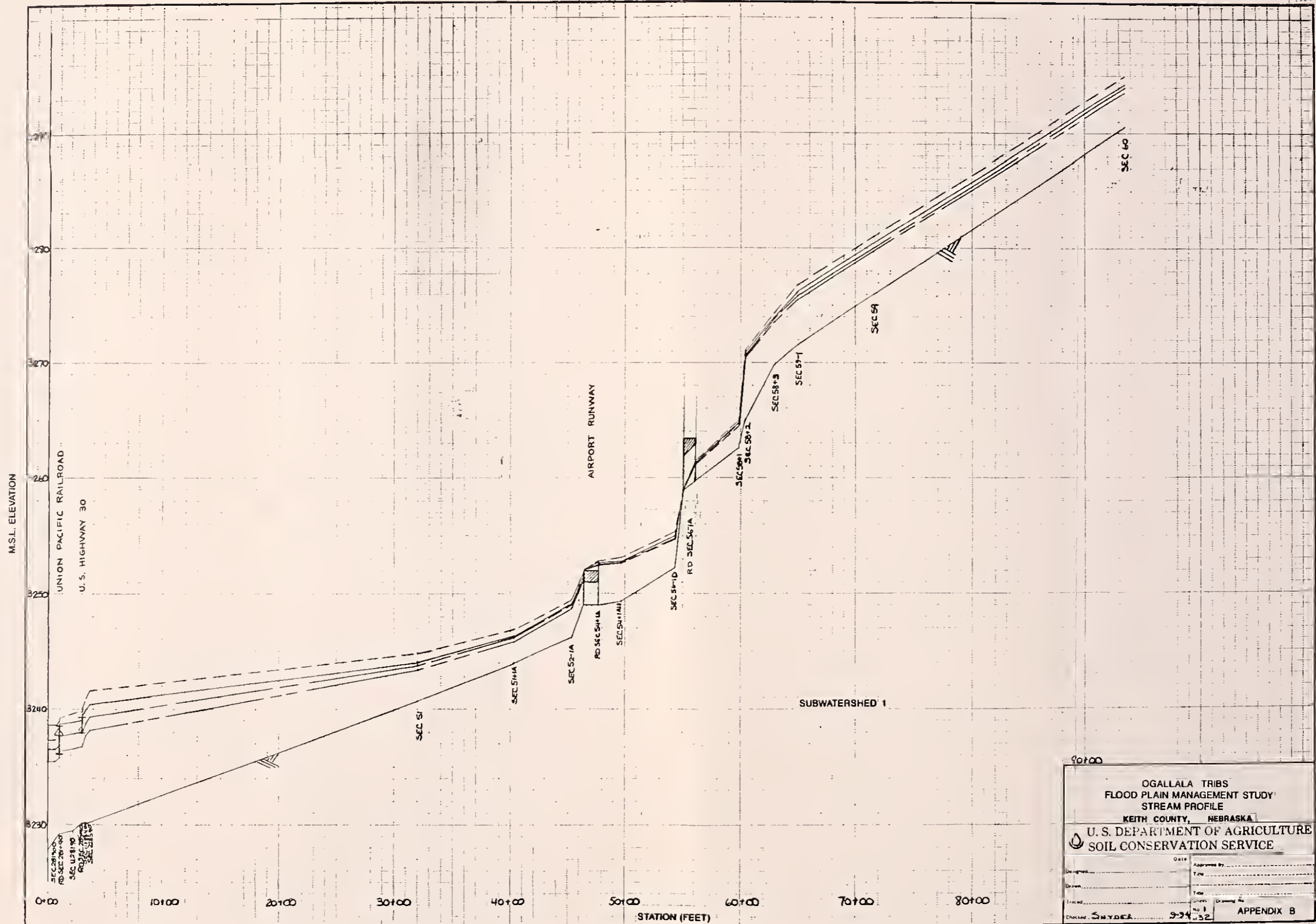
SHEET 26 OF 25

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
**OGALLALA TRIBUTARIES
FLOOD PLAIN MANAGEMENT STUDY
KEITH COUNTY
NEBRASKA**

FLOOD PLAIN MANAGEMENT STUDY OGALLALA TRIBUTARIES

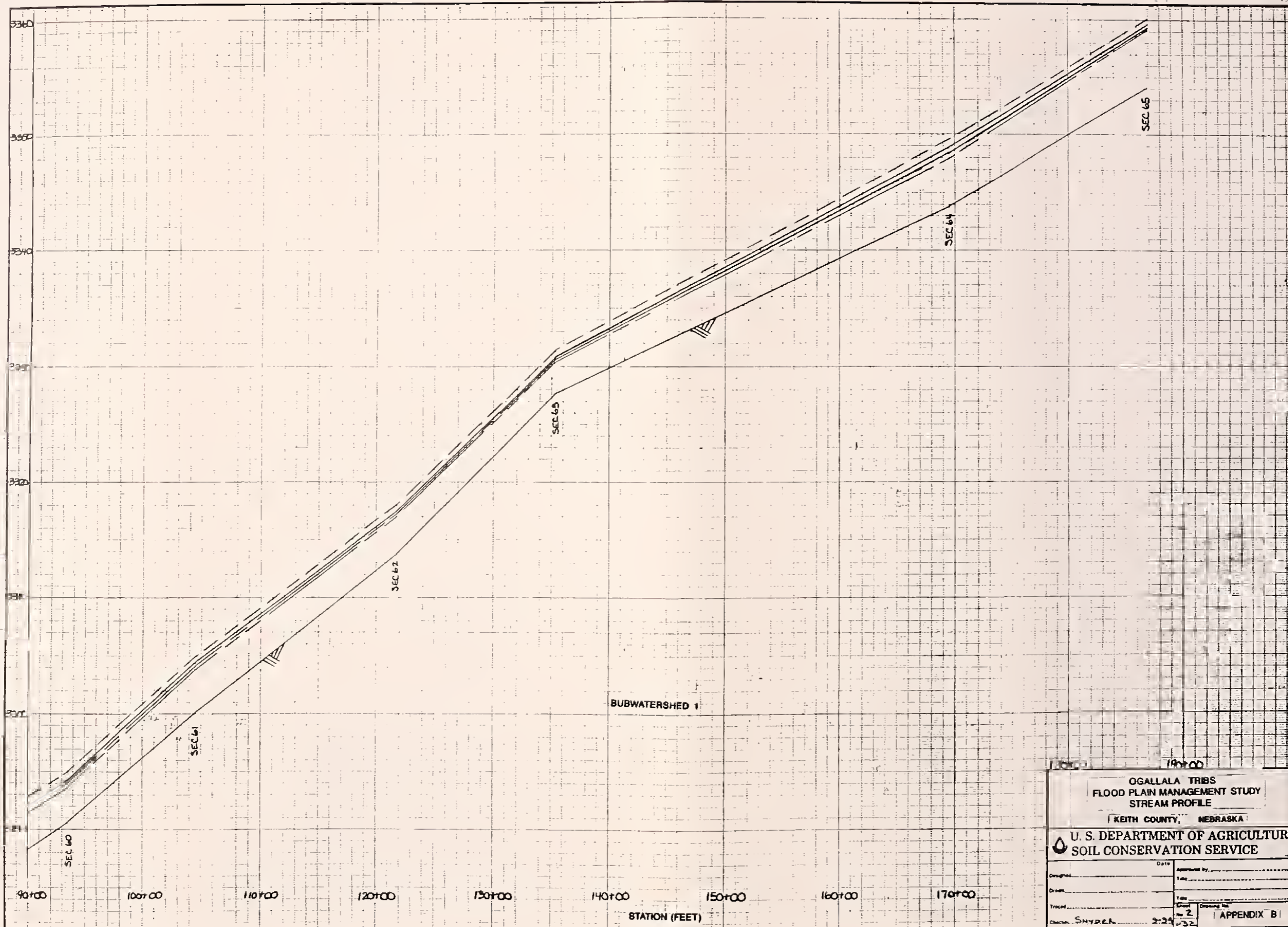
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F L O O D P R O F I L E S



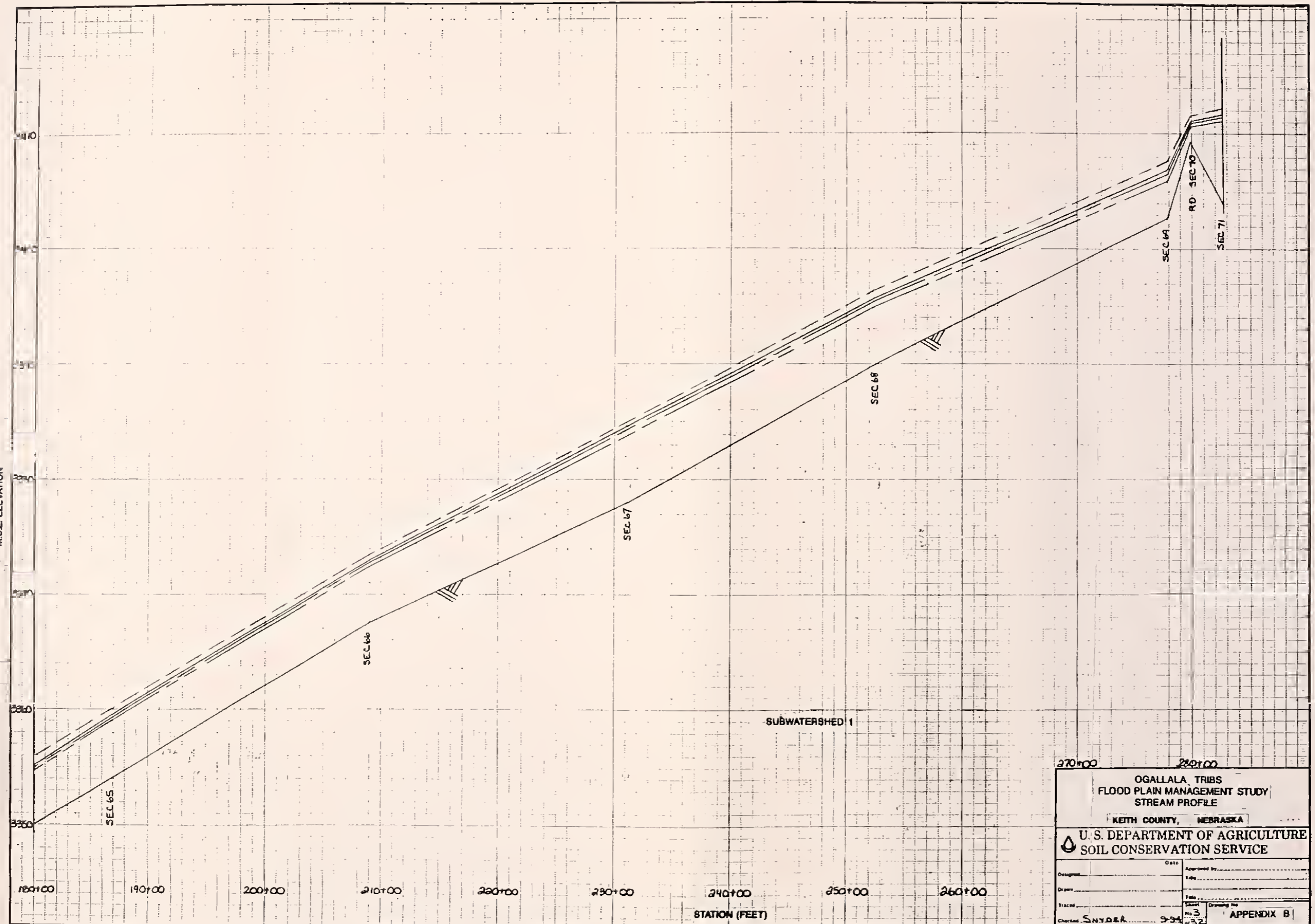
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U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	
Date	Approved By
Drawn	Title
Field	Title
Checked	Drawn By
DATE: SNYDER	9-24-52
APPENDIX B	

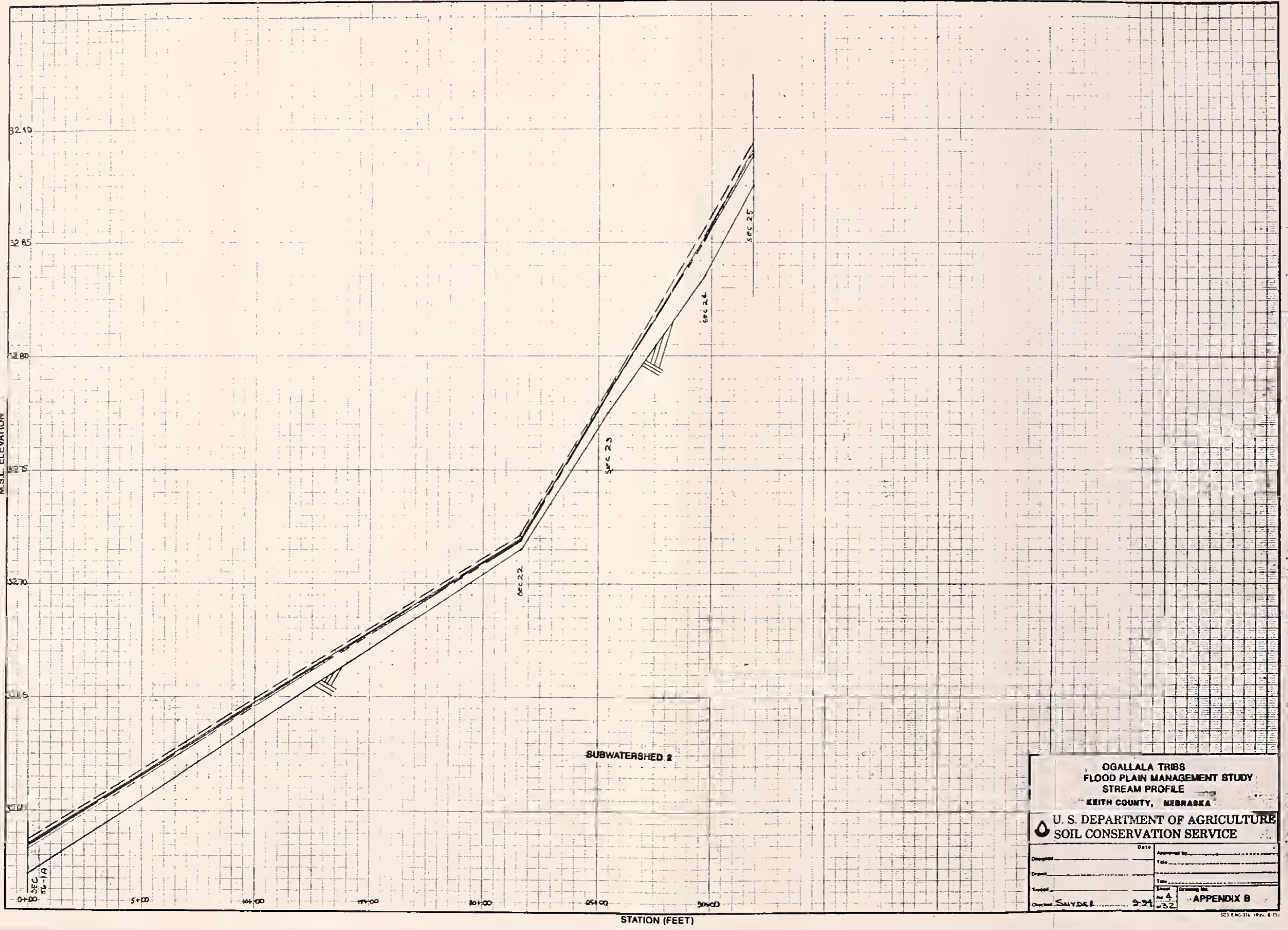
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OGALLALA TRIBS FLOOD PLAIN MANAGEMENT STUDY STREAM PROFILE			
KEITH COUNTY, NEBRASKA			
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE			
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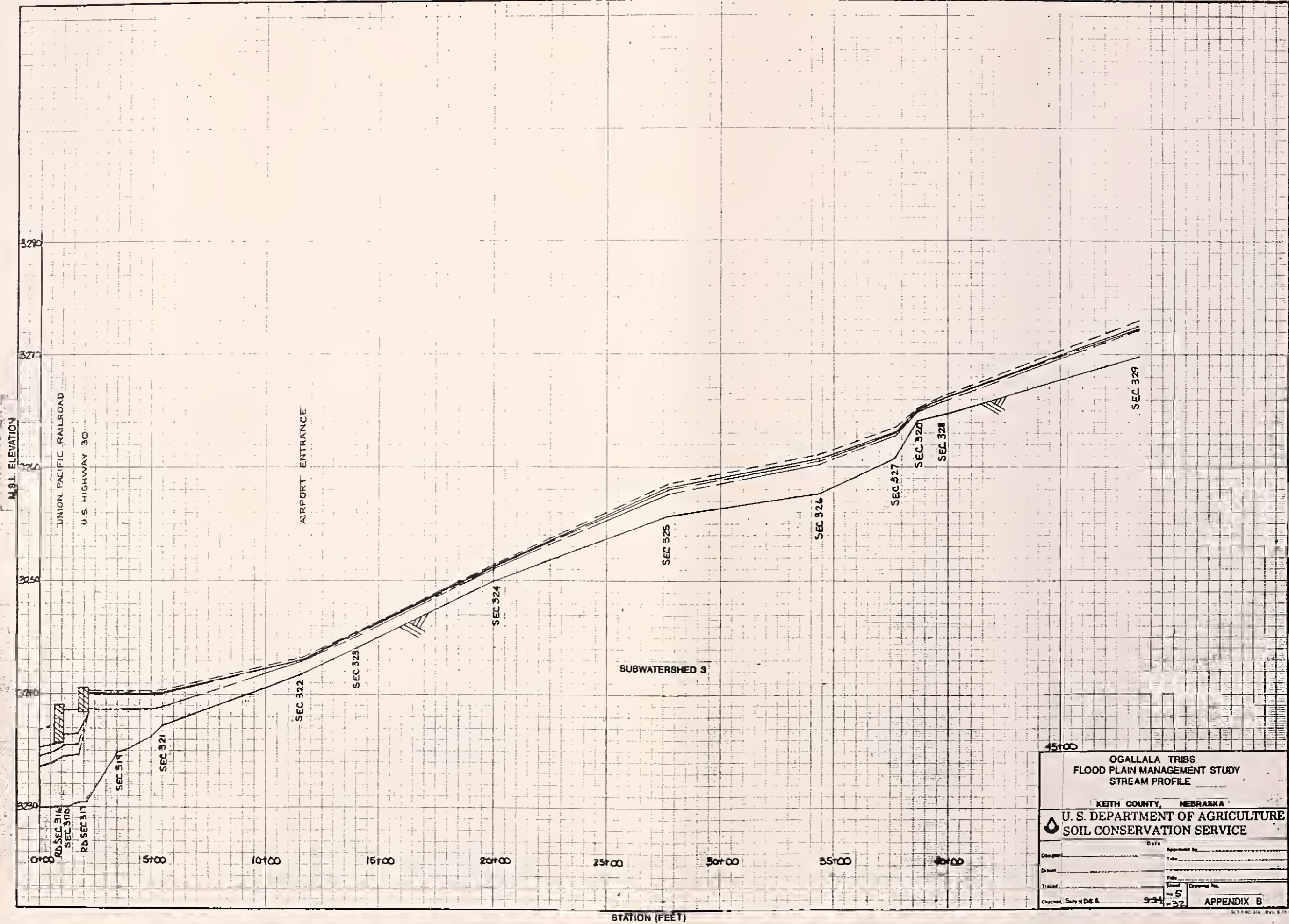


**OGALLALA TRIBES
FLOOD PLAIN MANAGEMENT STUDY
STREAM PROFILE
KEITH COUNTY, NEBRASKA**

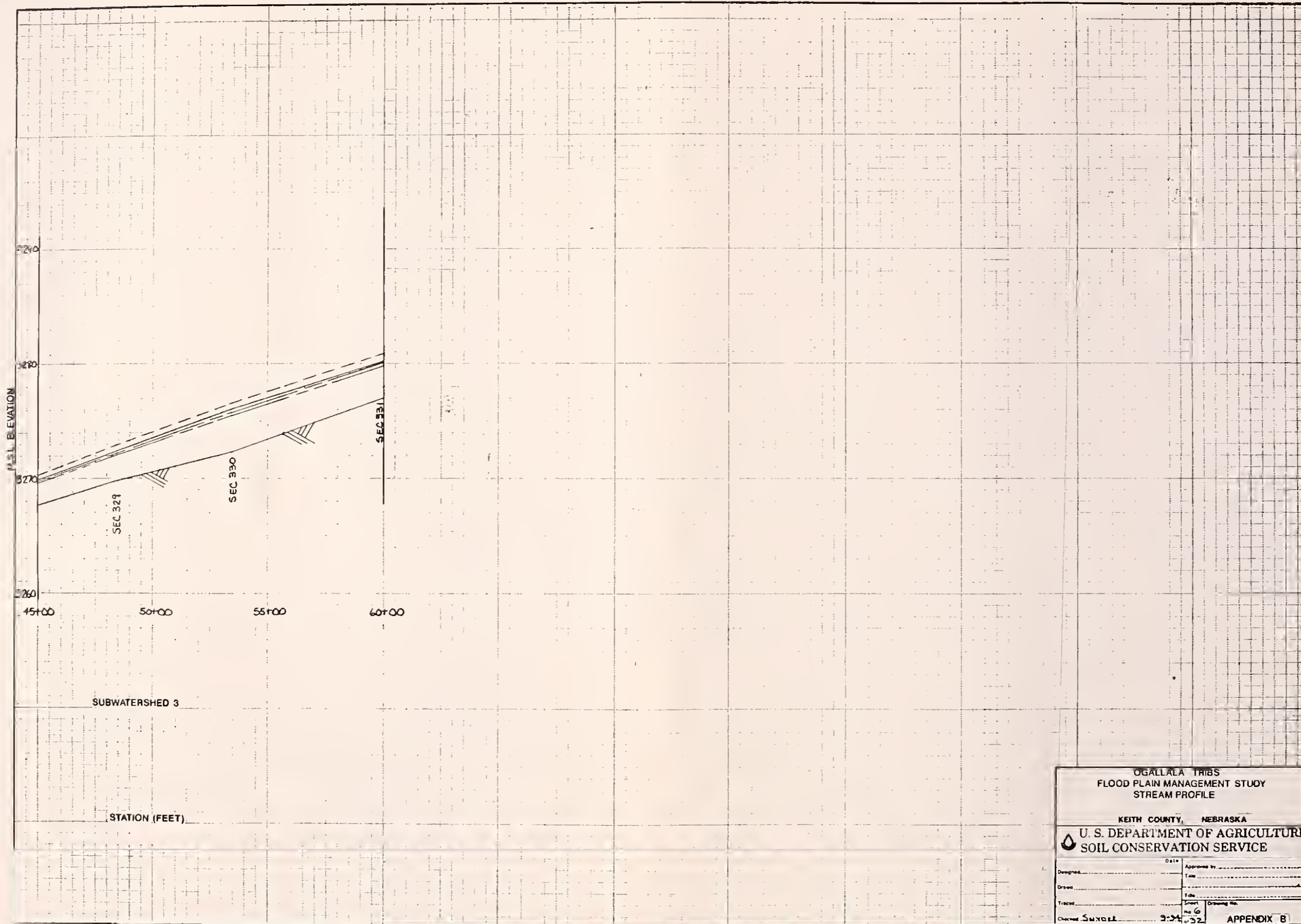
**U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE**

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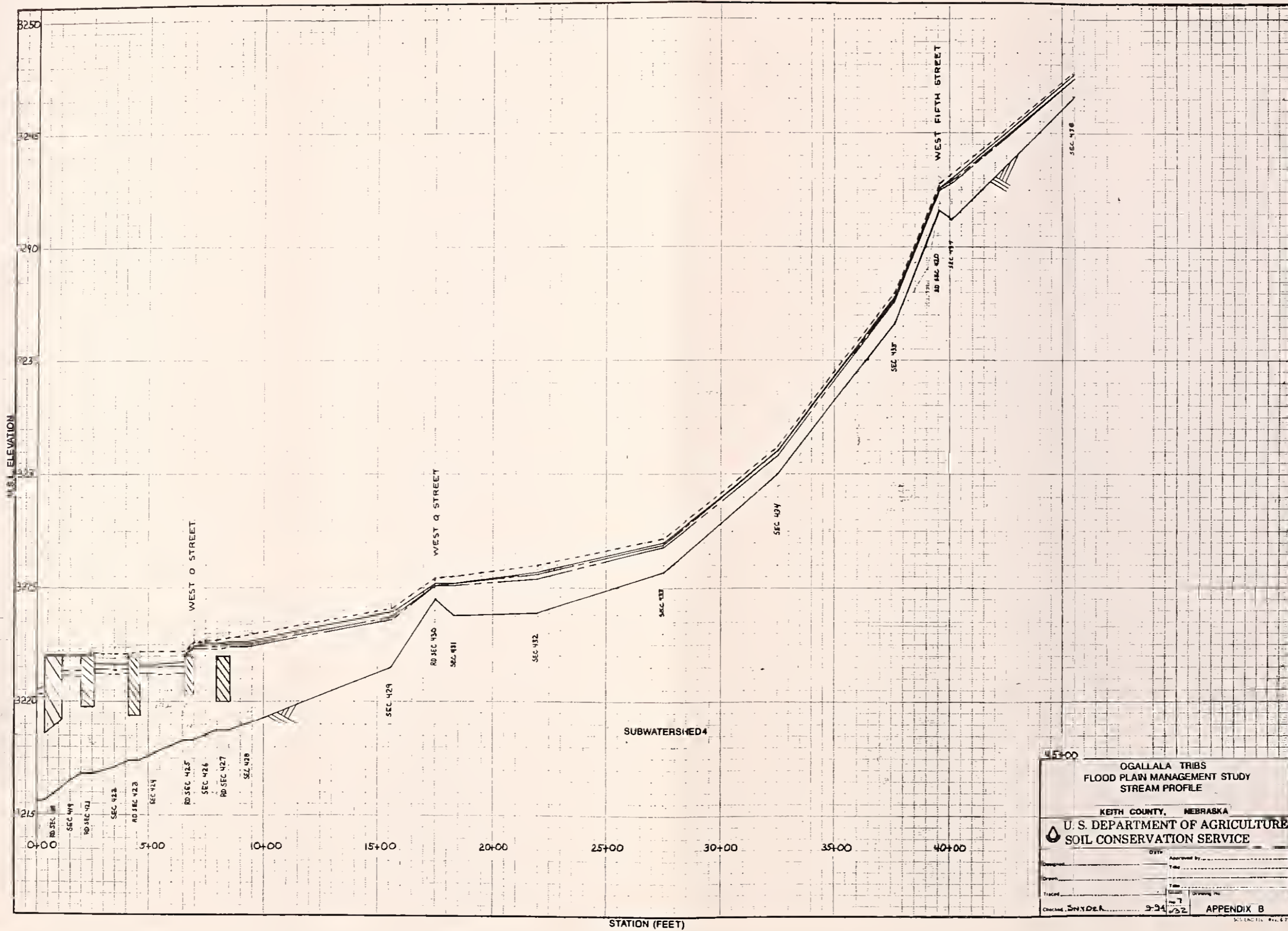
APPENDIX B



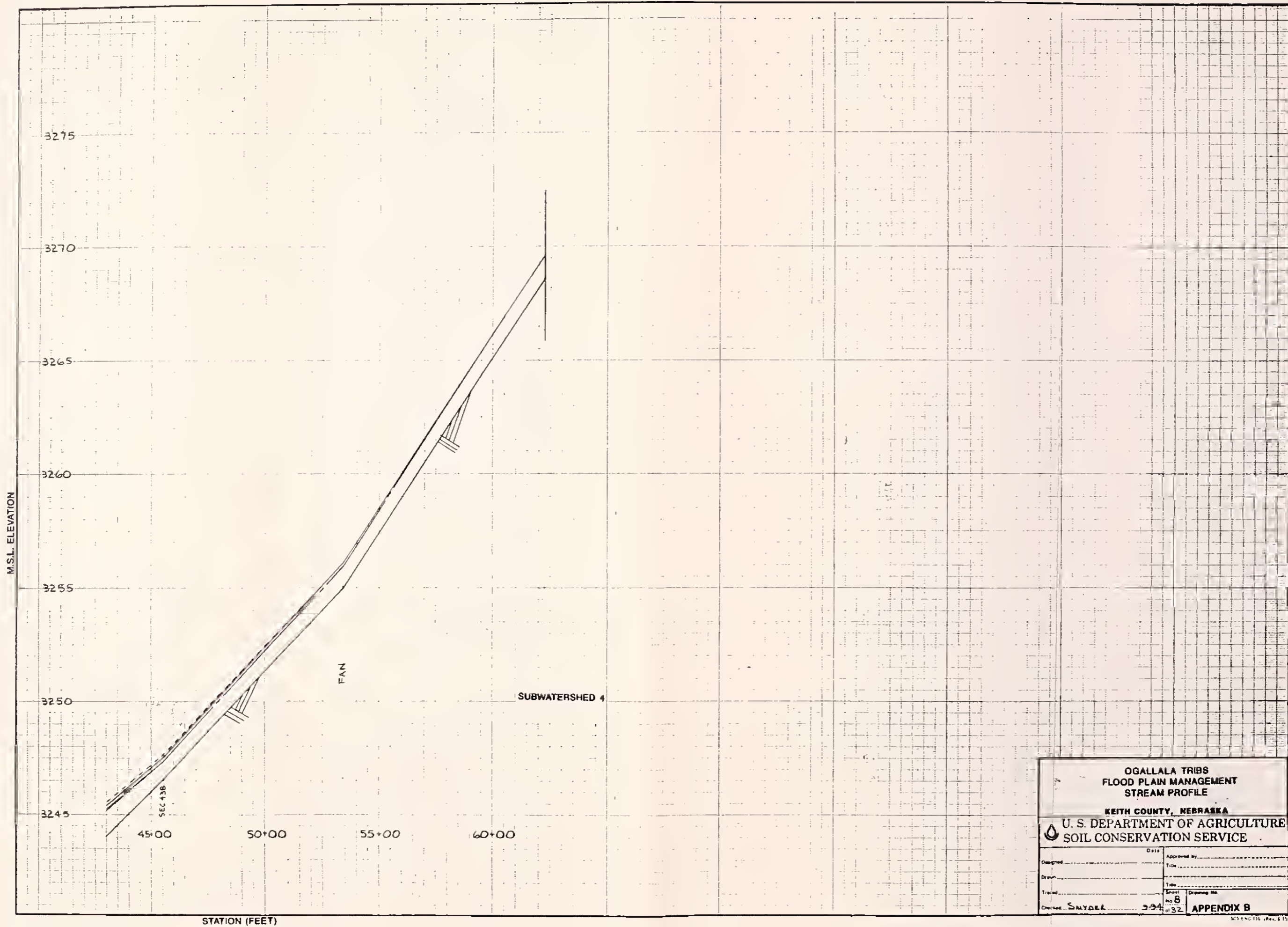
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KETH COUNTY, NEBRASKA	
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	
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Drawing No. _____	
APPENDIX B	



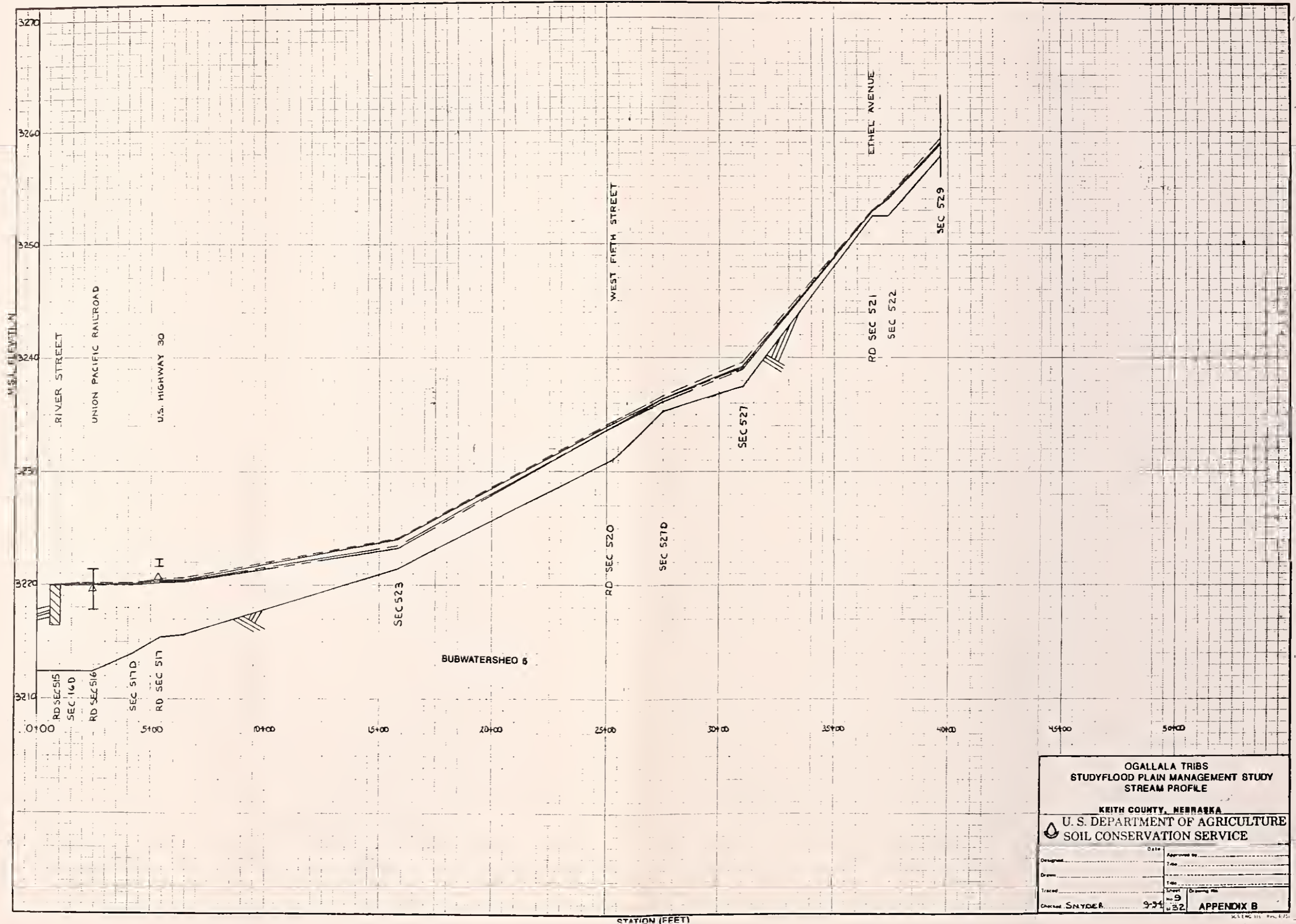
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KEITH COUNTY, NEBRASKA			
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE			
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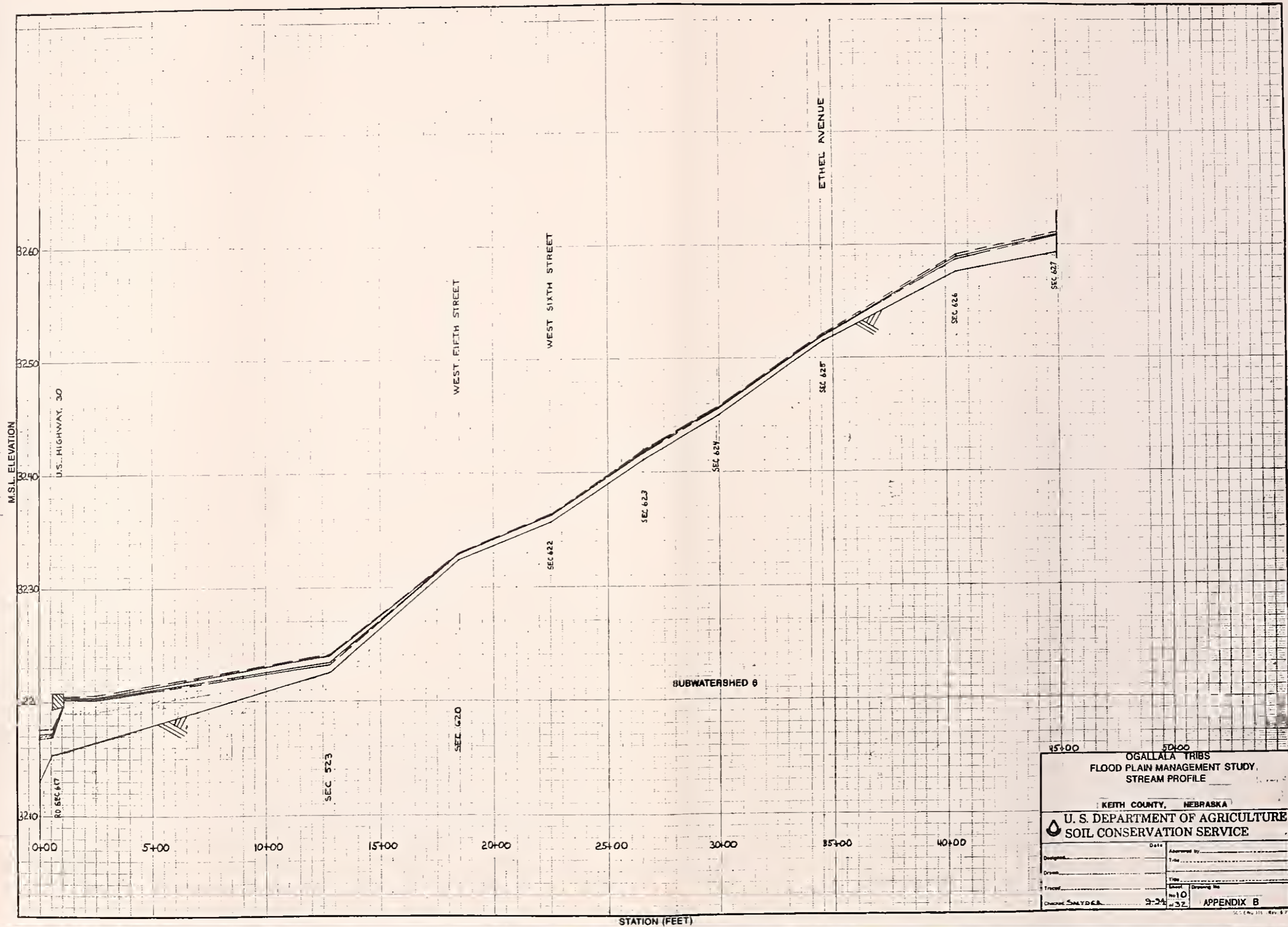
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KEITH COUNTY, NEBRASKA	
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	
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Drawn by _____	Approved by _____
Traced by _____	Title _____
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9-24-62	APPENDIX B



OGALLALA TRIBS FLOOD PLAIN MANAGEMENT STREAM PROFILE	
KEITH COUNTY, NEBRASKA	
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	
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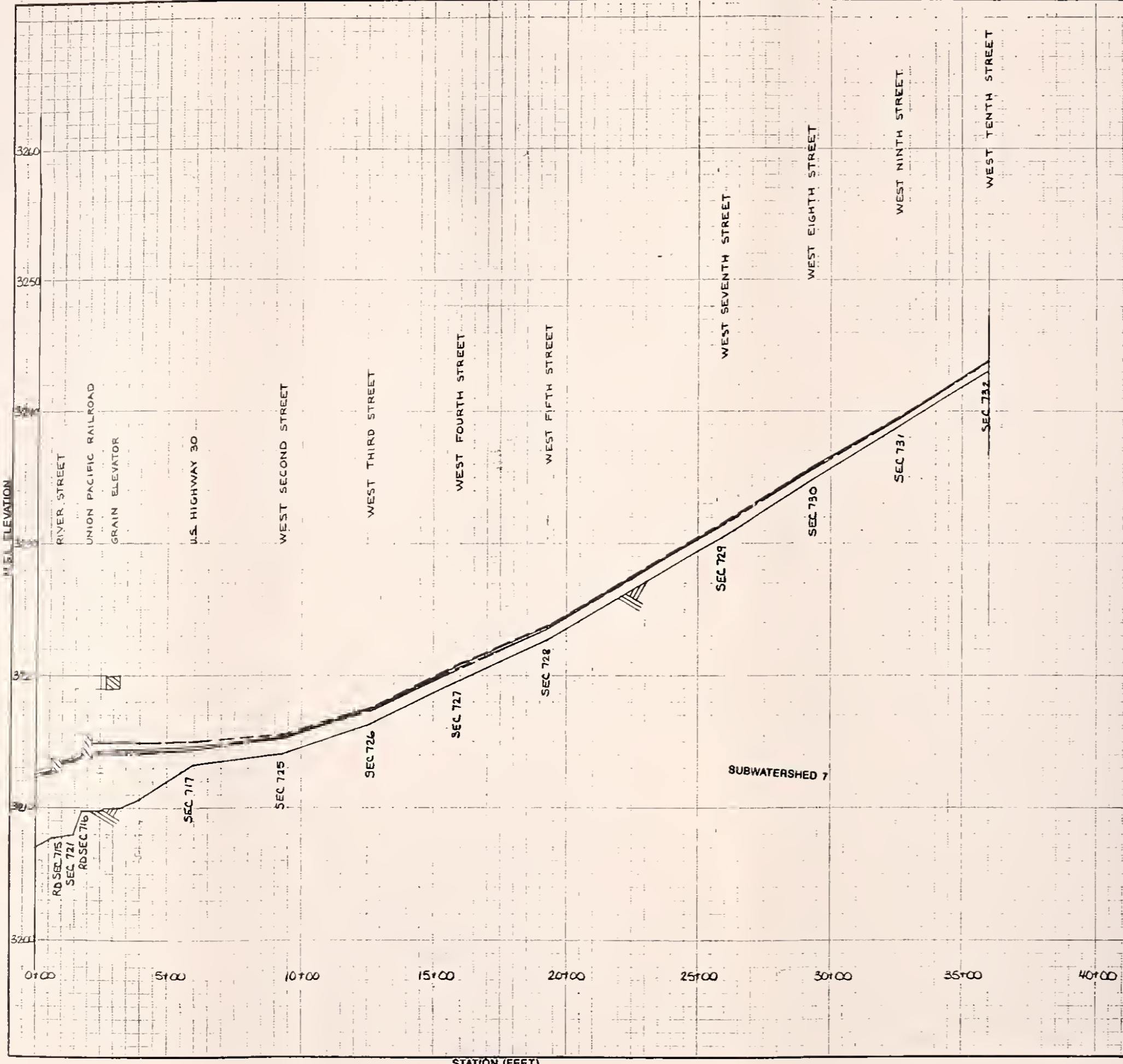


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KEITH COUNTY, NEBRASKA	
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	
Designed by _____	Date _____
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9-34	APPENDIX B

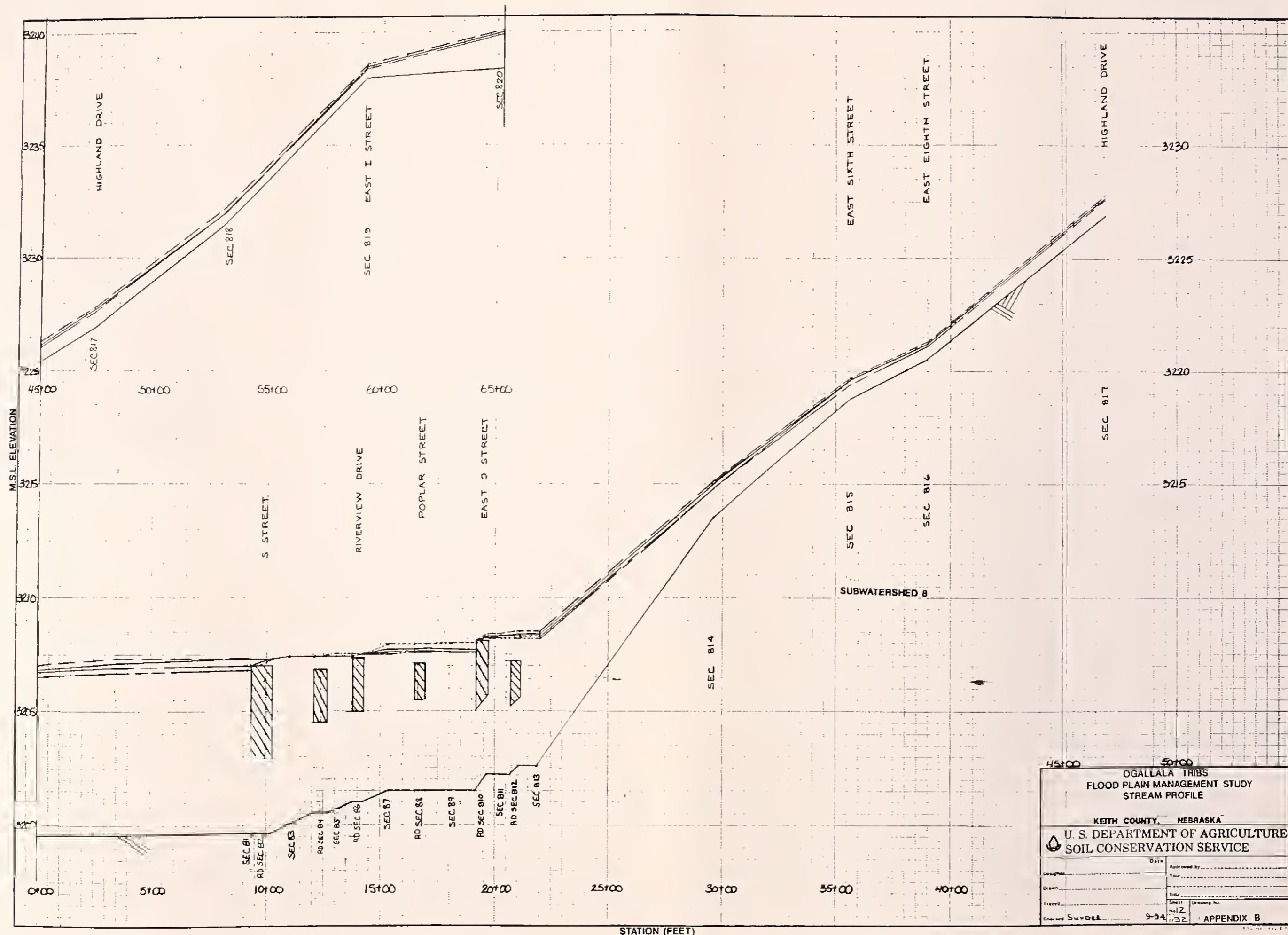


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KEITH COUNTY, NEBRASKA			
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE			
Designed by _____	Date _____	Approved by _____	Title _____
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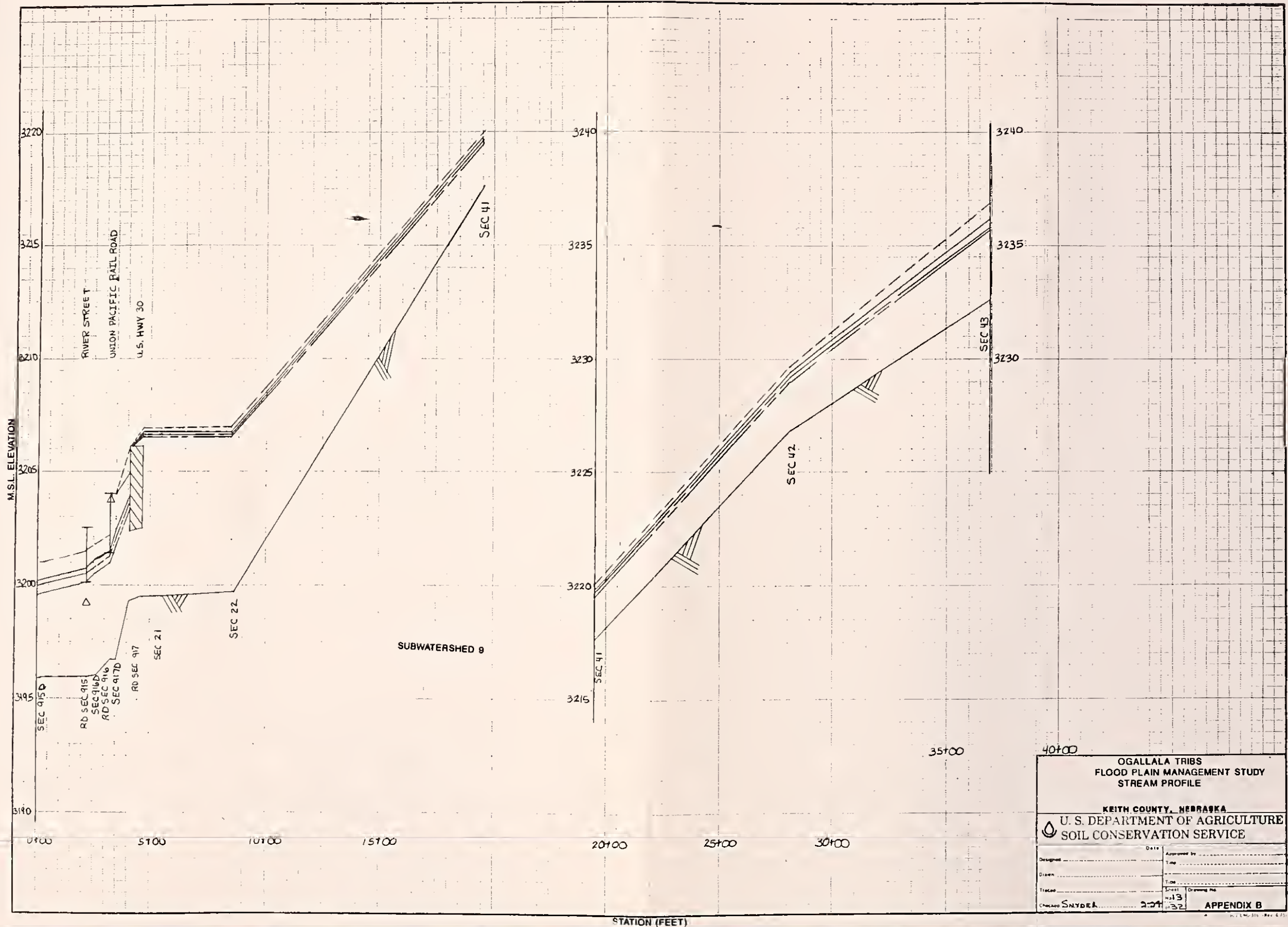




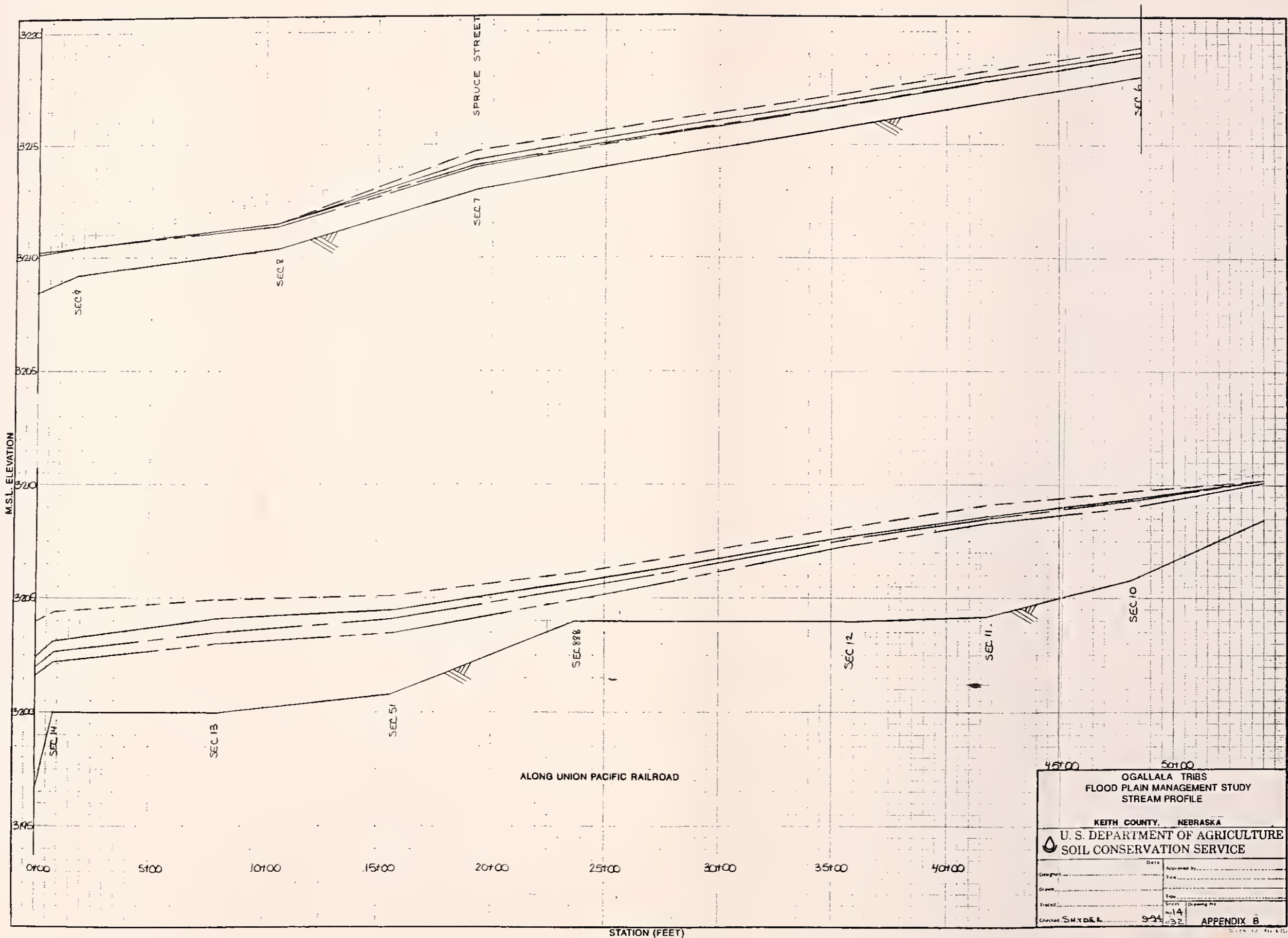
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KEITH COUNTY, NEBRASKA			
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE			
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Drawn _____		Title _____	
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APPENDIX B			



OGALLALA TRIBS FLOOD PLAIN MANAGEMENT STUDY STREAM PROFILE			
KEITH COUNTY, NEBRASKA			
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE			
Designed by	Date	Approved by	
Drawn		Title	
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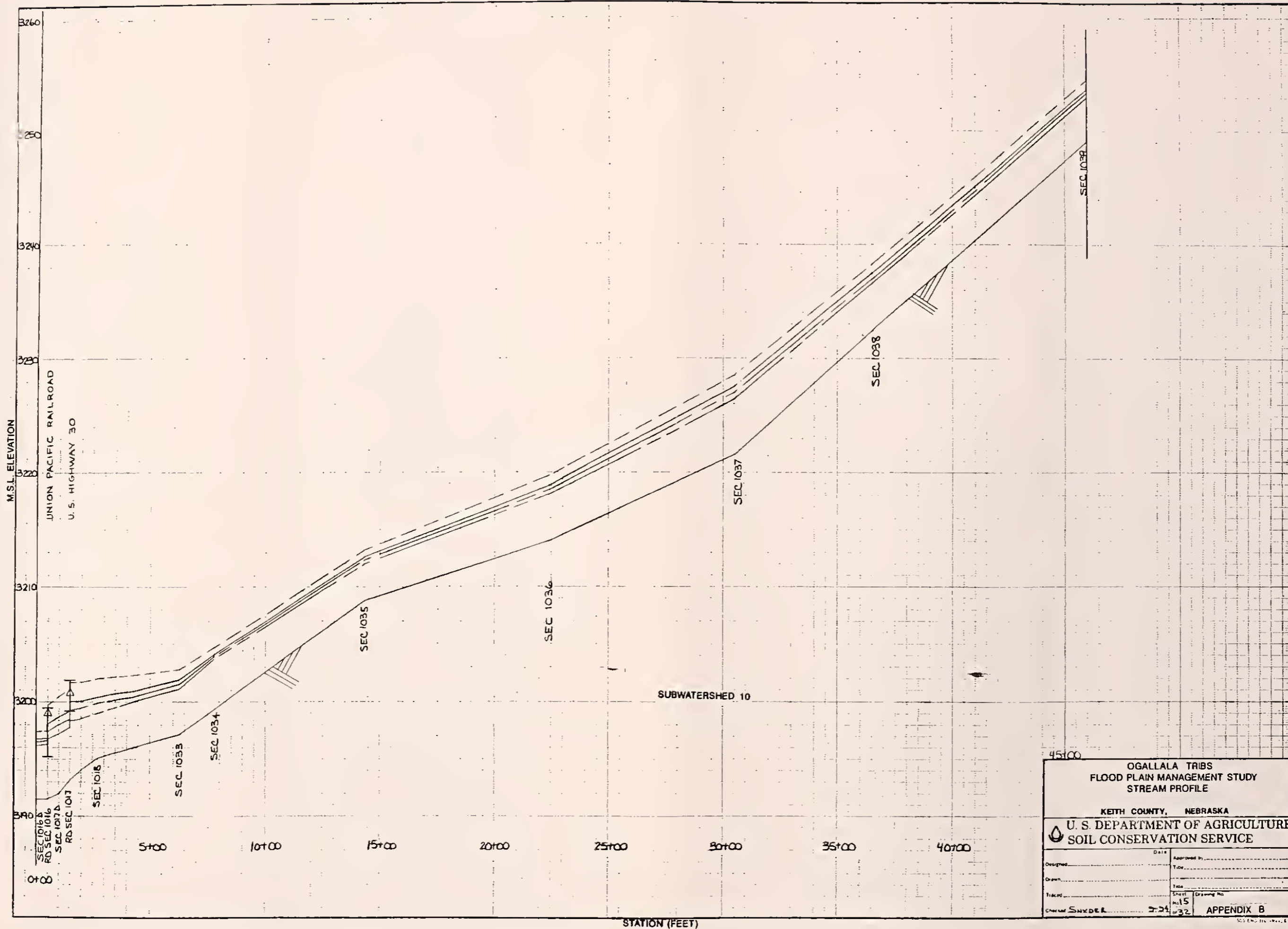


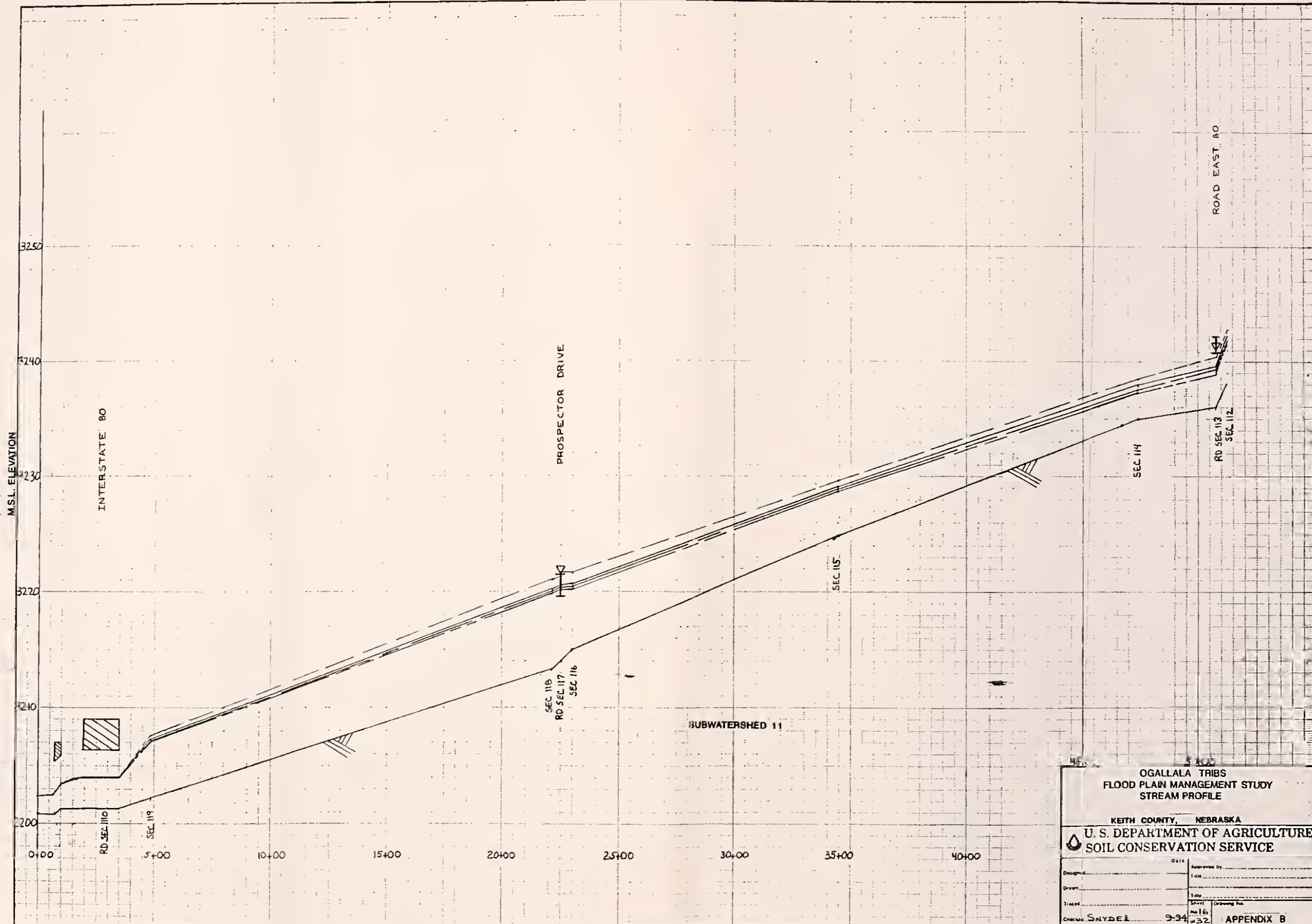
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KEITH COUNTY, NEBRASKA	
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	
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APPENDIX B	



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APPENDIX B	

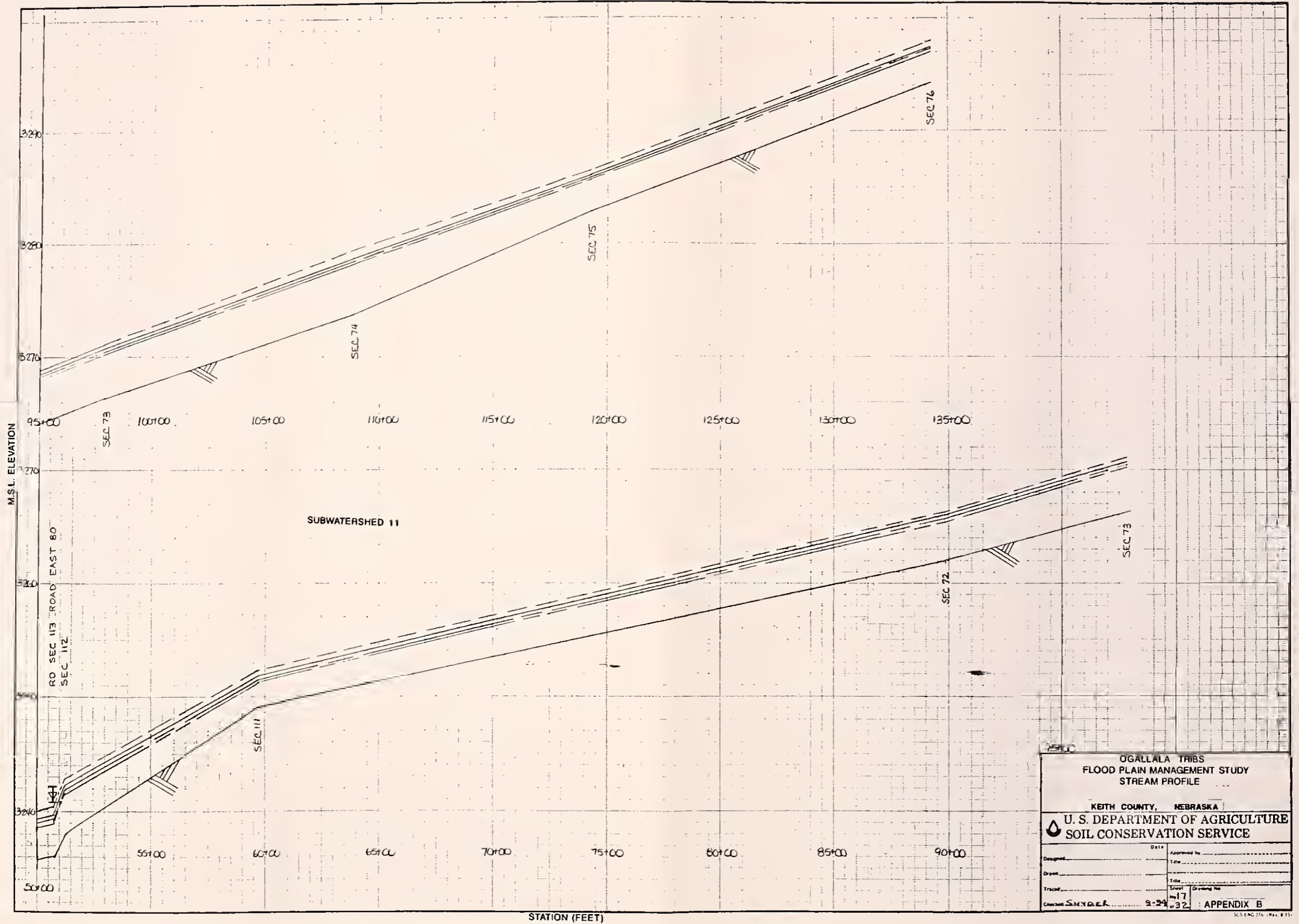
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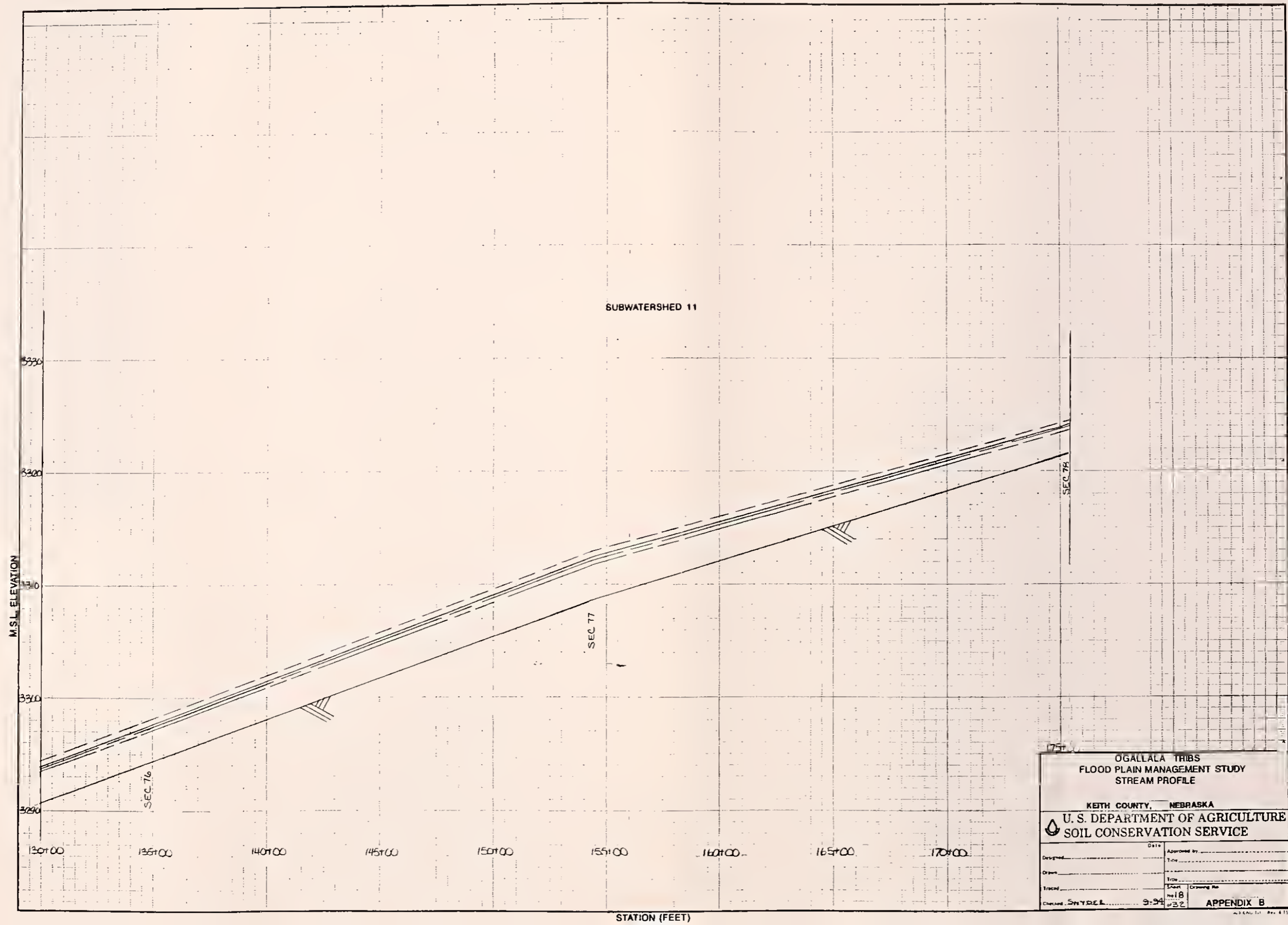




OGALLALA TRIBES FLOOD PLAIN MANAGEMENT STUDY STREAM PROFILE			
KEITH COUNTY, NEBRASKA			
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE			
Designed by _____	Date _____	Approved by _____	Title _____
Drawn by _____	Scale _____	Checked by _____	Drawing No. _____
Traced by _____	Sheet No. 16 of 32	Checked by SNYDER	9-24
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STATION (FEET)





OGALLALA TRIBS
FLOOD PLAIN MANAGEMENT STUDY
STREAM PROFILE

KEITH COUNTY, NEBRASKA



U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Date _____

Designed _____ approved with _____ of _____ dated _____ by _____

Citizens _____

Total _____

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Approved by _____

Time _____

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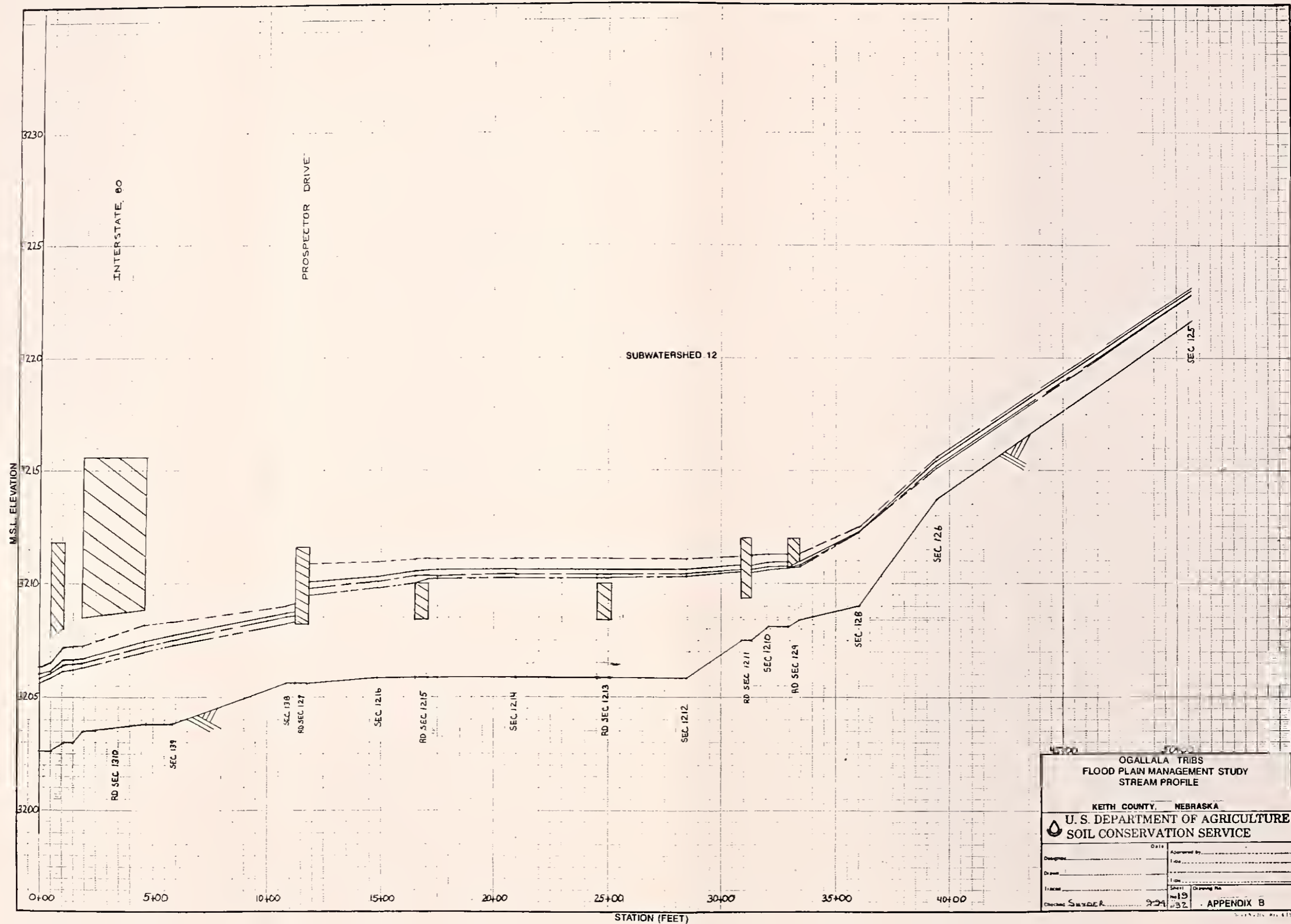
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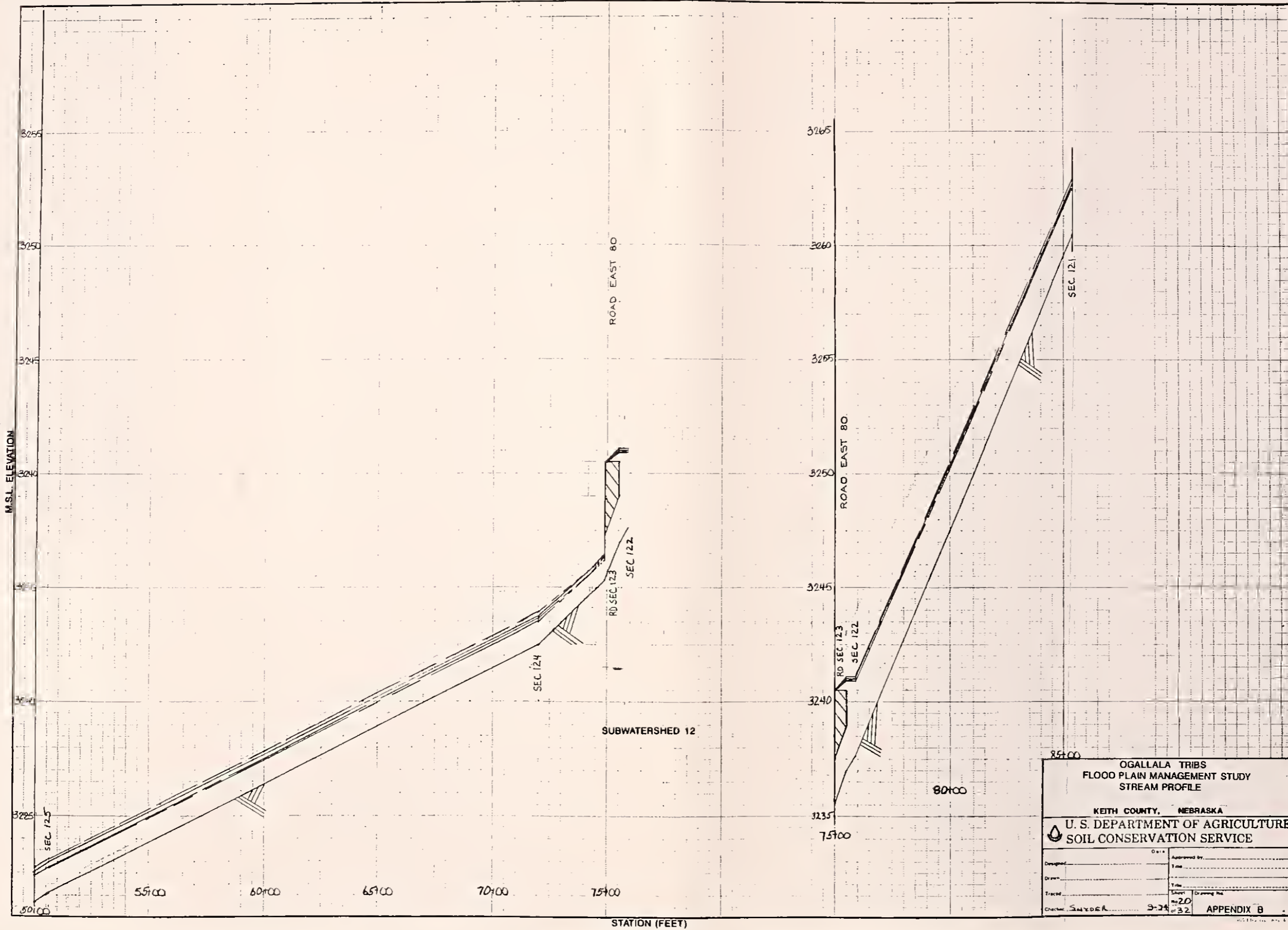
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RESEARCH DESIGN AND METHODS

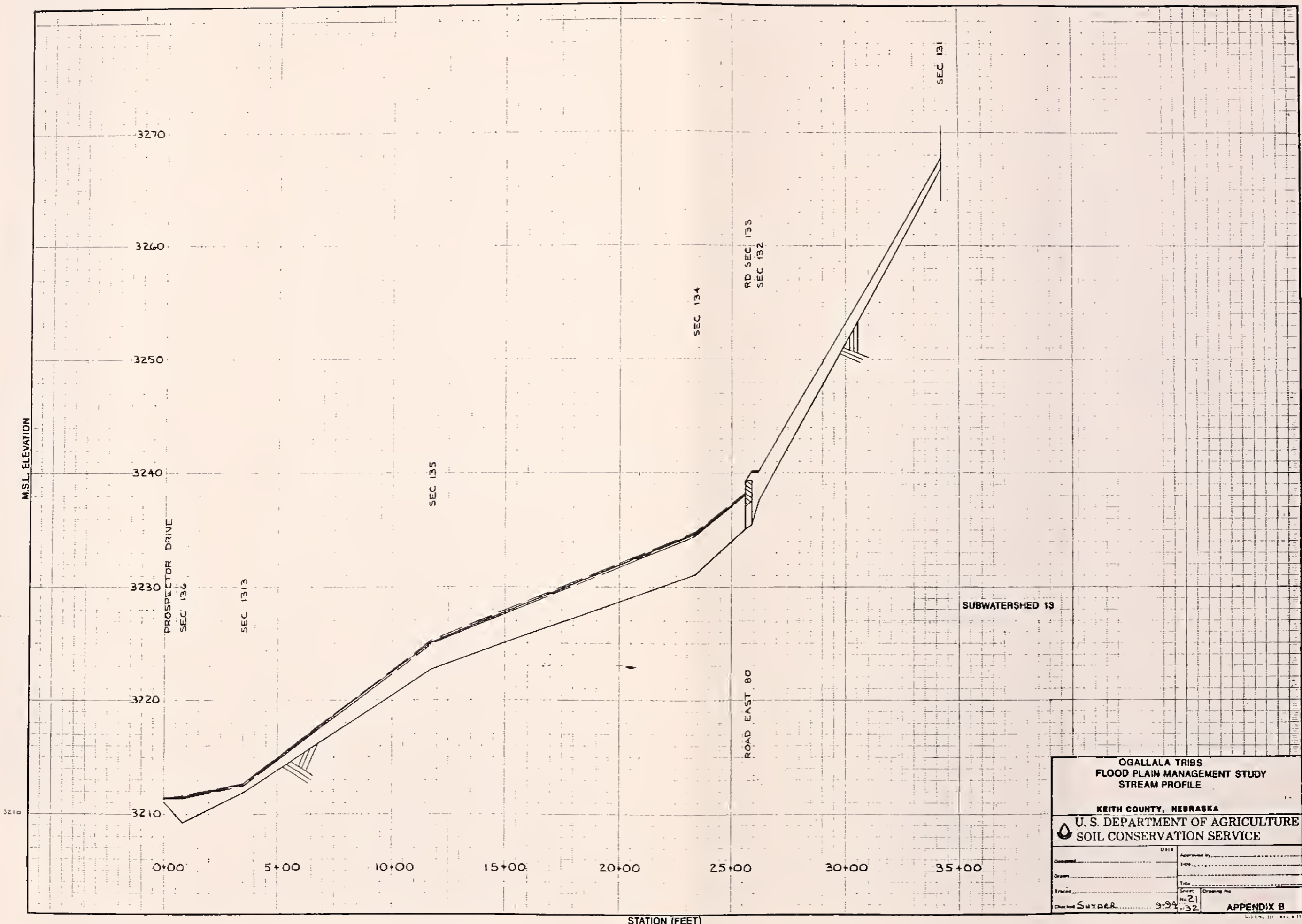
Page 10

APPENDIX B



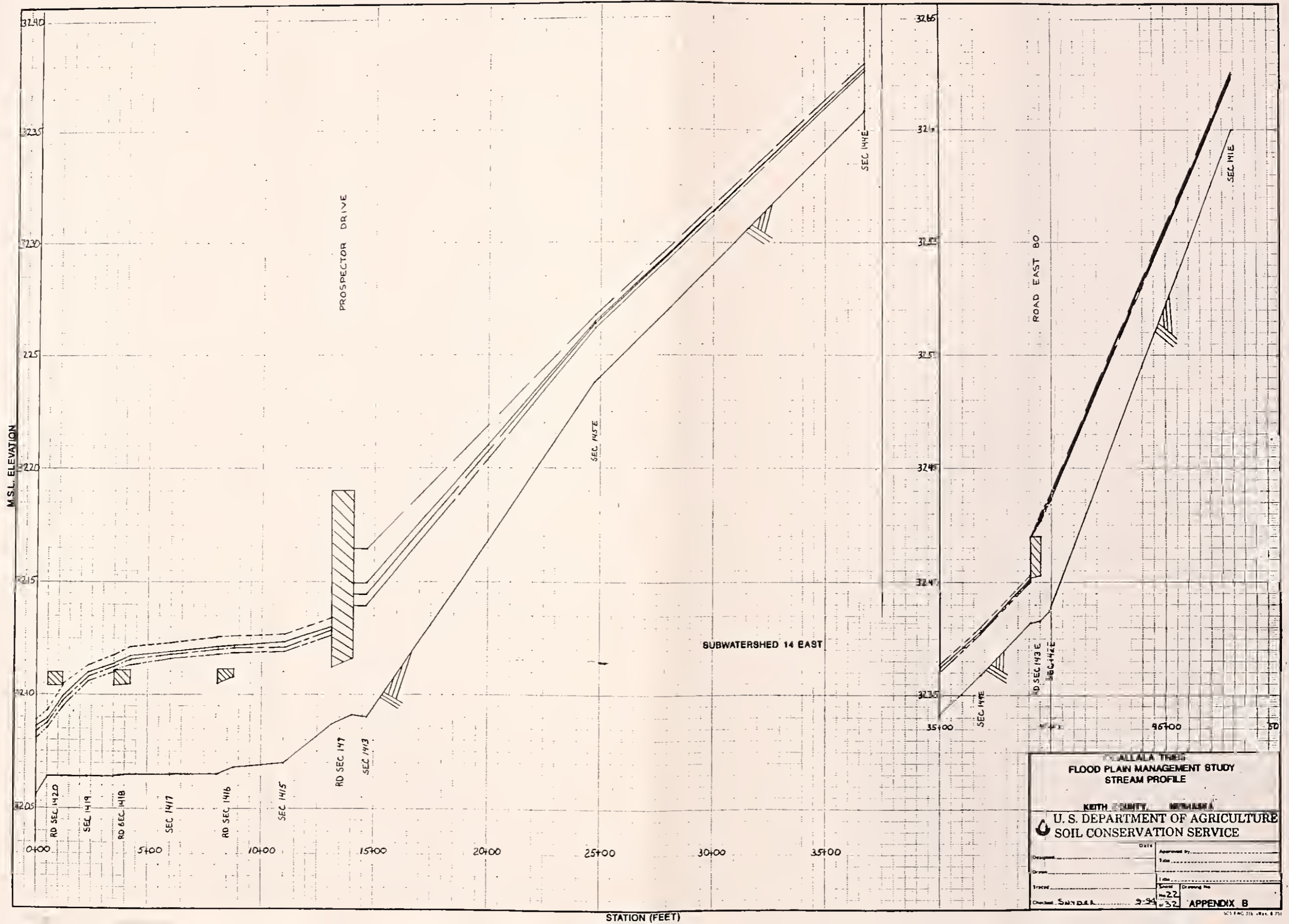


OGALLALA TRIBES FLOOD PLAIN MANAGEMENT STUDY STREAM PROFILE			
KEITH COUNTY, NEBRASKA			
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE			
Designed by _____	Date _____	Approved by _____	Time _____
Drawn by _____			
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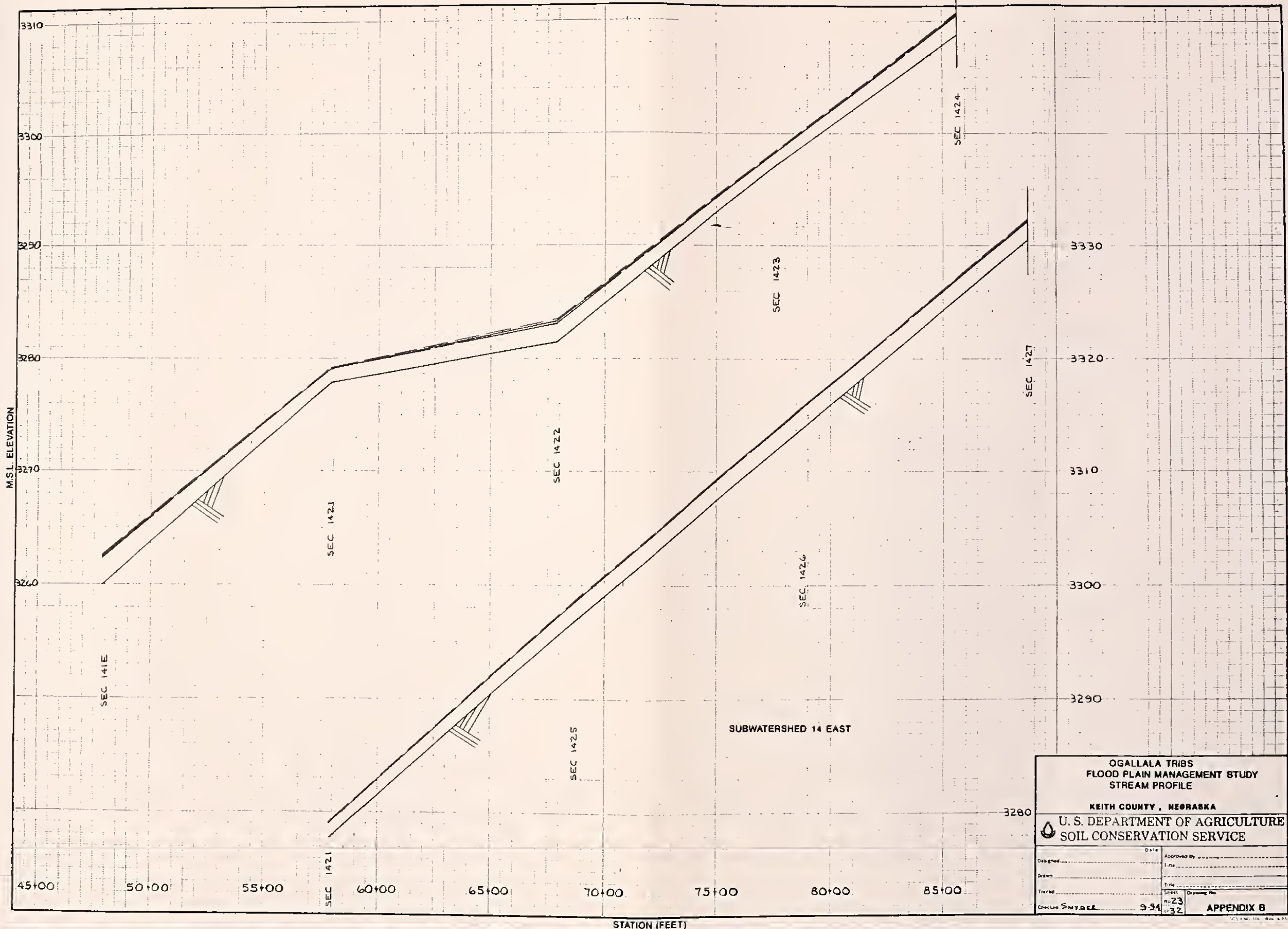


OGALLALA TRIBS FLOOD PLAIN MANAGEMENT STUDY STREAM PROFILE			
KEITH COUNTY, NEBRASKA			
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE			
Designed _____	Date _____	Approved by _____	
Drawn _____		Title _____	
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			APPENDIX B

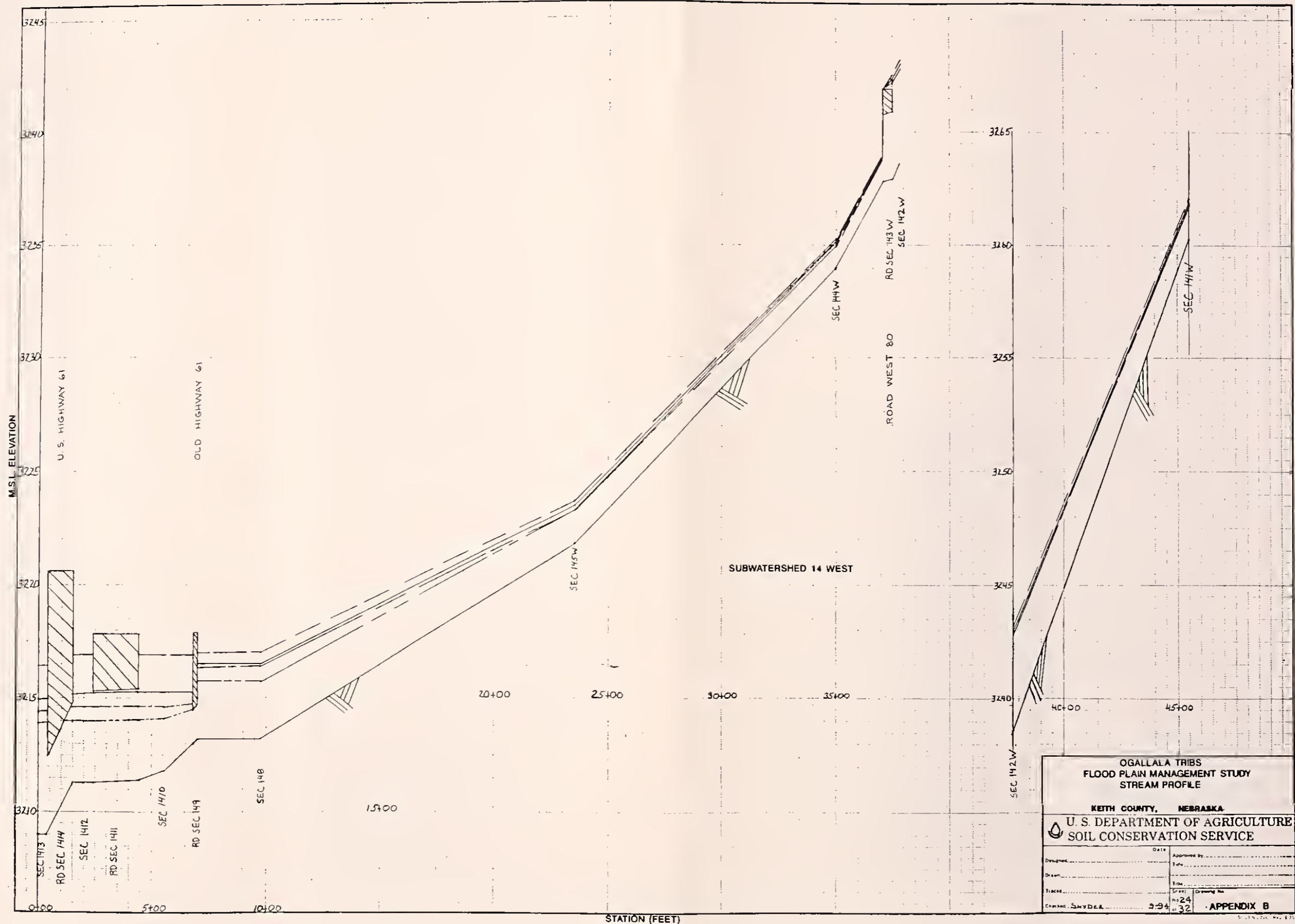
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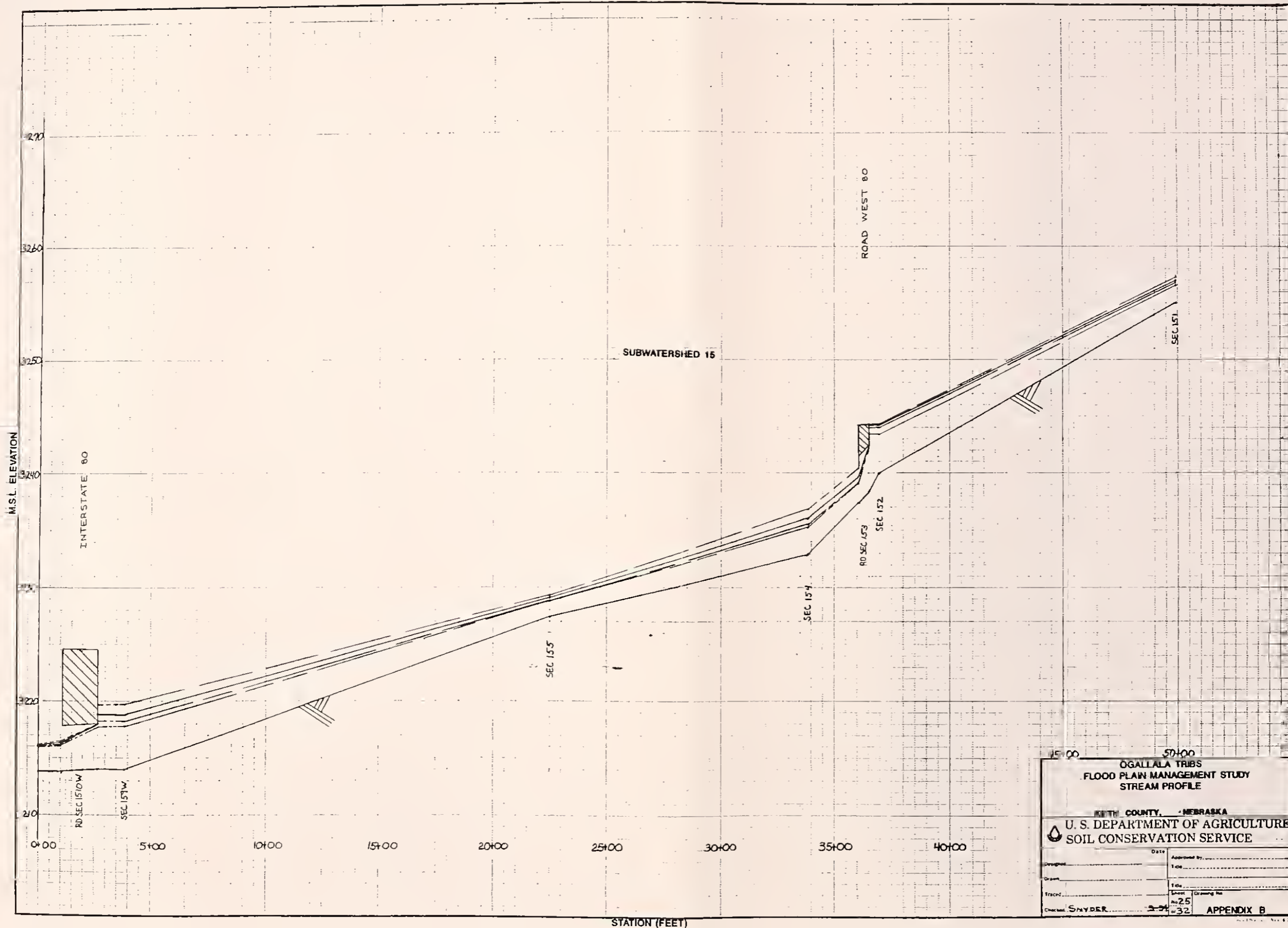


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KEITH COUNTY, NEBRASKA	
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	
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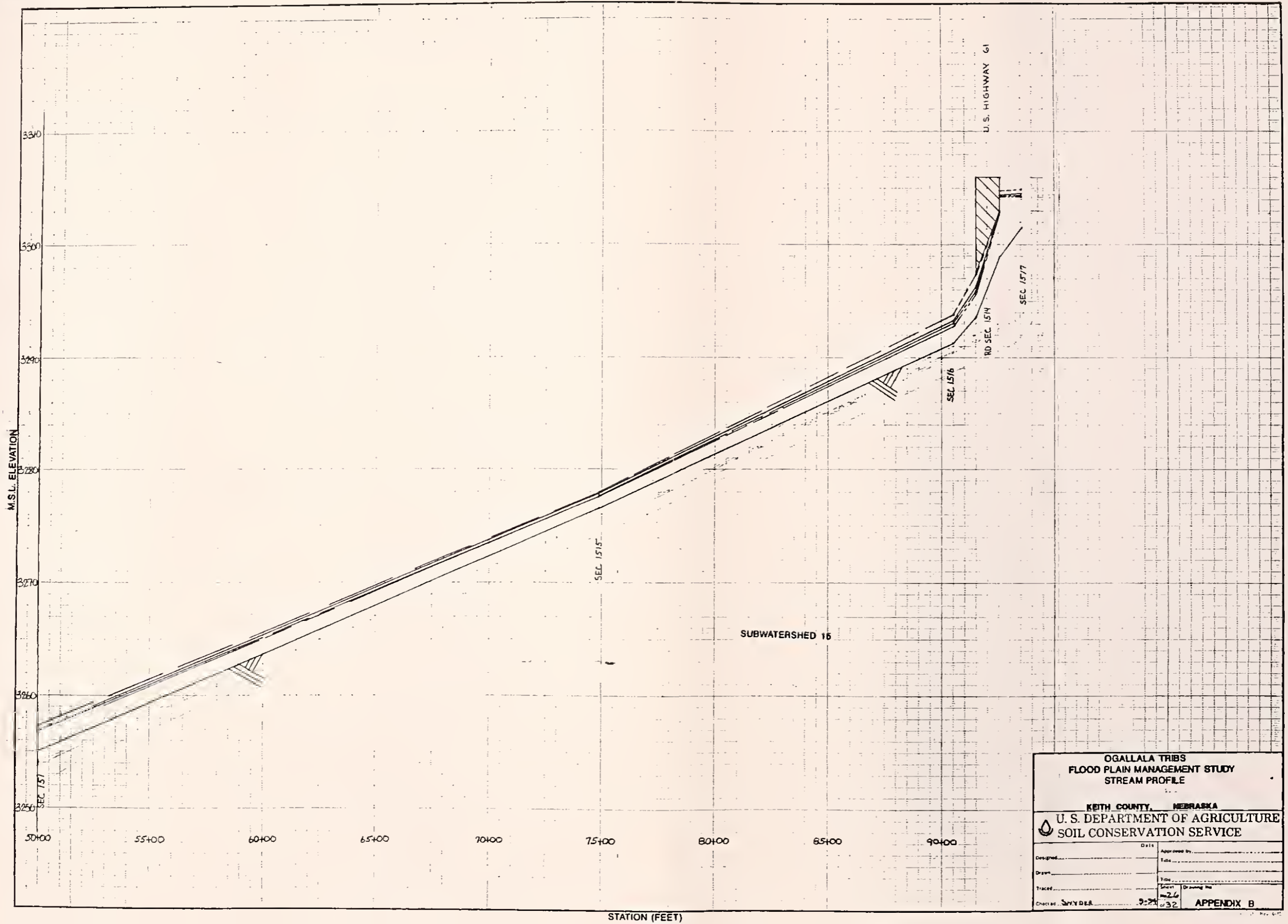


OGALLALA TRIBS FLOOD PLAIN MANAGEMENT STUDY STREAM PROFILE			
KEITH COUNTY, NEBRASKA			
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE			
Designed	Date	Approved by	
Drawn		Title	
Trace		Sheet	23
Checked	9-94	of 32	
			APPENDIX B

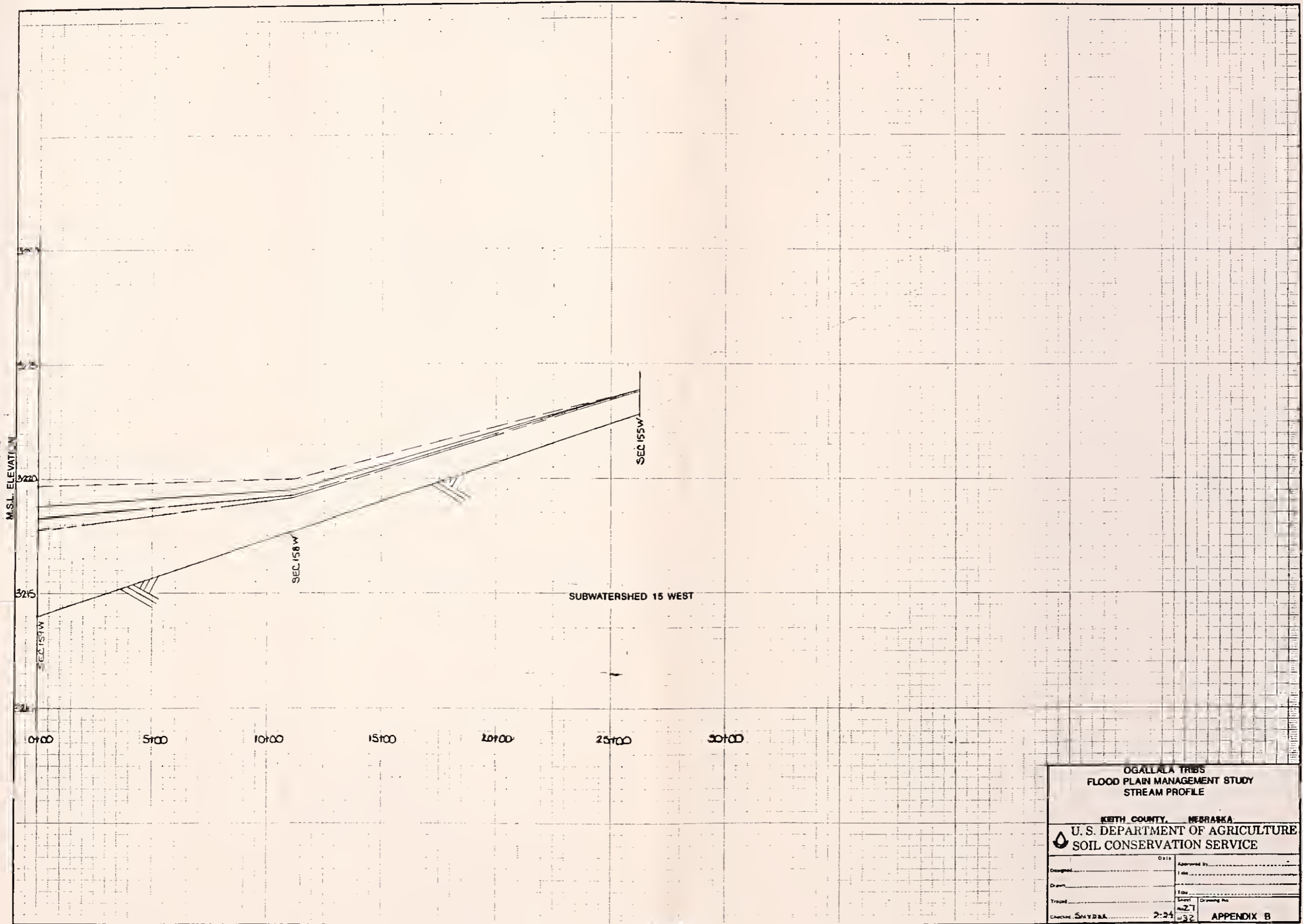




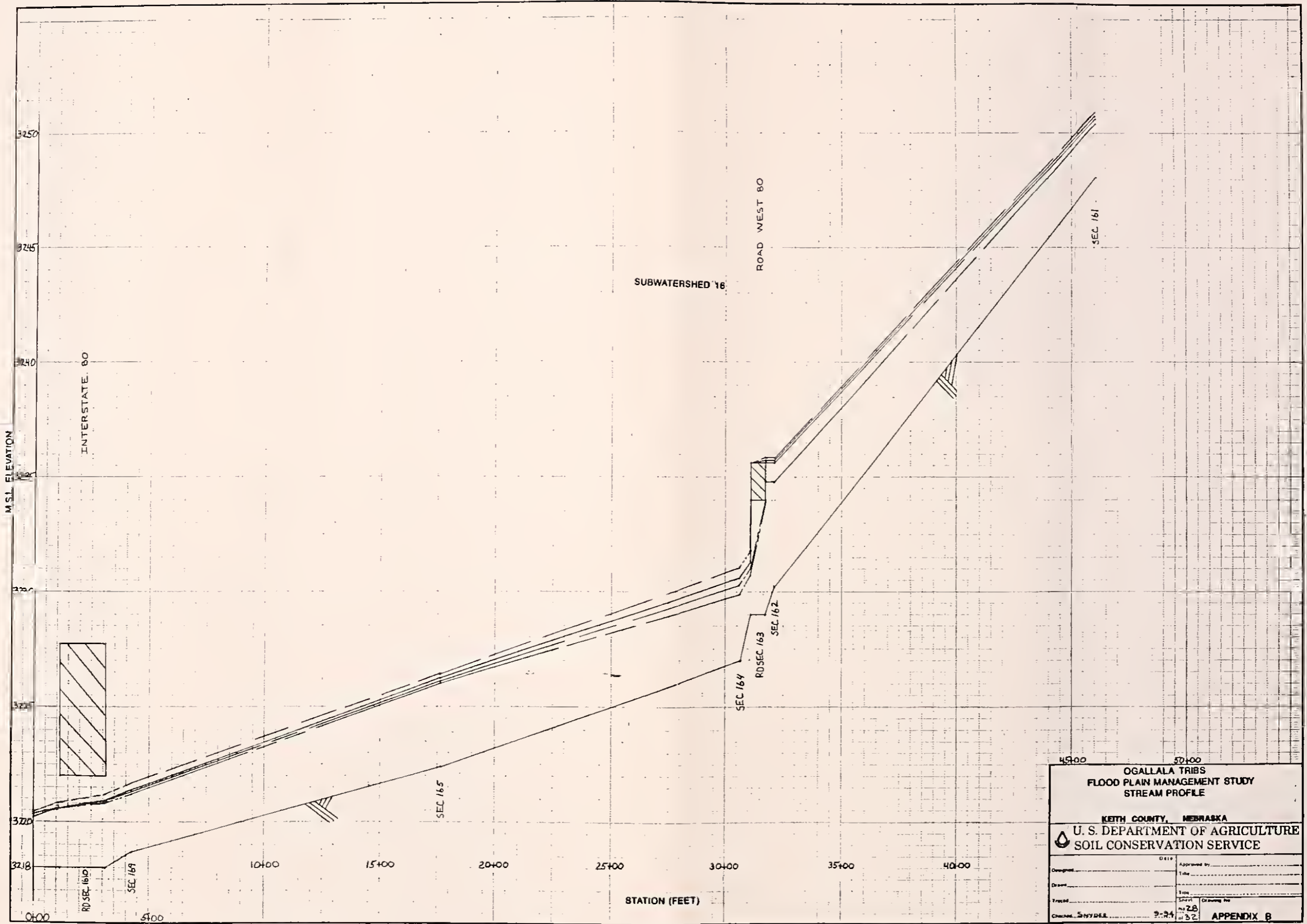
OGALLALA TRIBS FLOOD PLAIN MANAGEMENT STUDY STREAM PROFILE	
NORTH COUNTY, NEBRASKA	
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	
Date	Approved By
Designed	Title
Drawn	Title
Traced	Sheet No. 25 of 32
Checked SNYDER	APPENDIX B



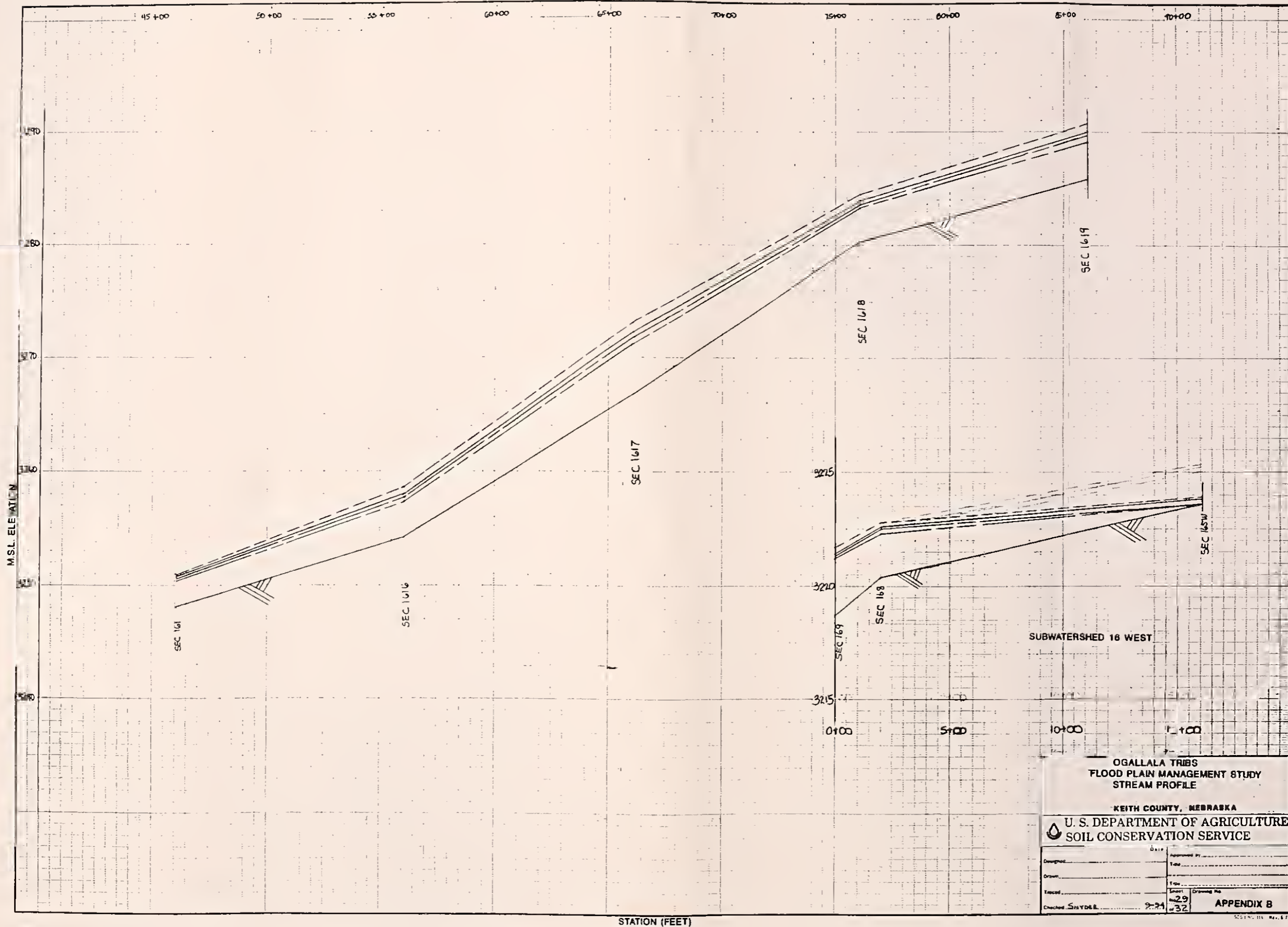
OGALLALA TRIBES FLOOD PLAIN MANAGEMENT STUDY STREAM PROFILE			
KEITH COUNTY, NEBRASKA			
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE			
Designed	Date	Approved by	Title
Drawn	Date	Traced	Sheet
Checked	Date	of 32	APPENDIX B



OGALLALA TRIBES FLOOD PLAIN MANAGEMENT STUDY STREAM PROFILE			
KEITH COUNTY, NEBRASKA			
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE			
Designed by _____	Date _____	Approved by _____	_____
Drawn by _____	_____	Title _____	_____
Trace by _____	_____	Sheet No. 27	Drawing No. _____
Checked by SNYDER	2-24-32	APPENDIX B	

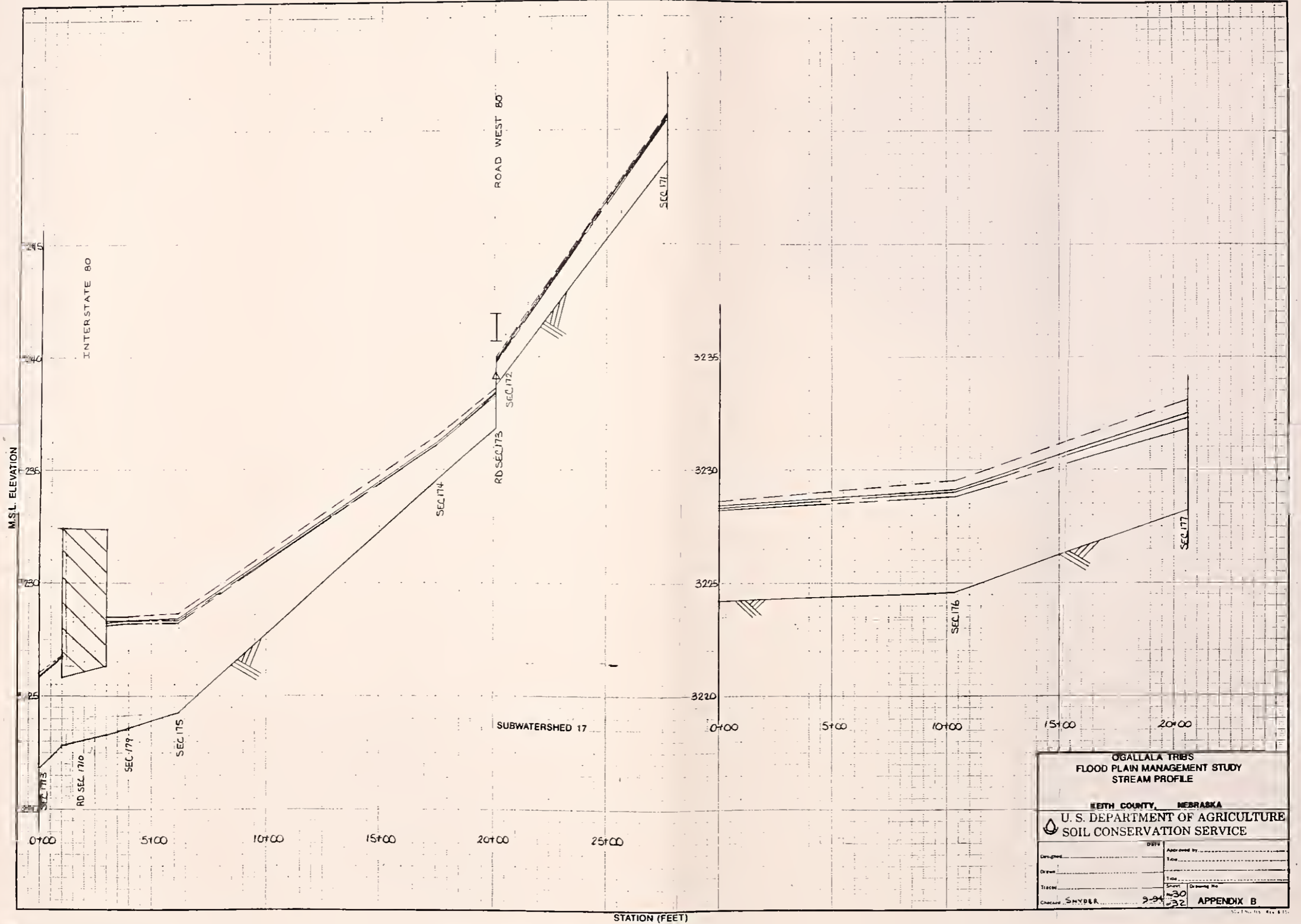


OGALLALA TRIBS FLOOD PLAIN MANAGEMENT STUDY STREAM PROFILE	
KEITH COUNTY, NEBRASKA	
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	
Original	Date
Drawn	Approved by
Traced	Title
Checked	Time
Checked	Sheet
Checked	of 32
Checked	APPENDIX B



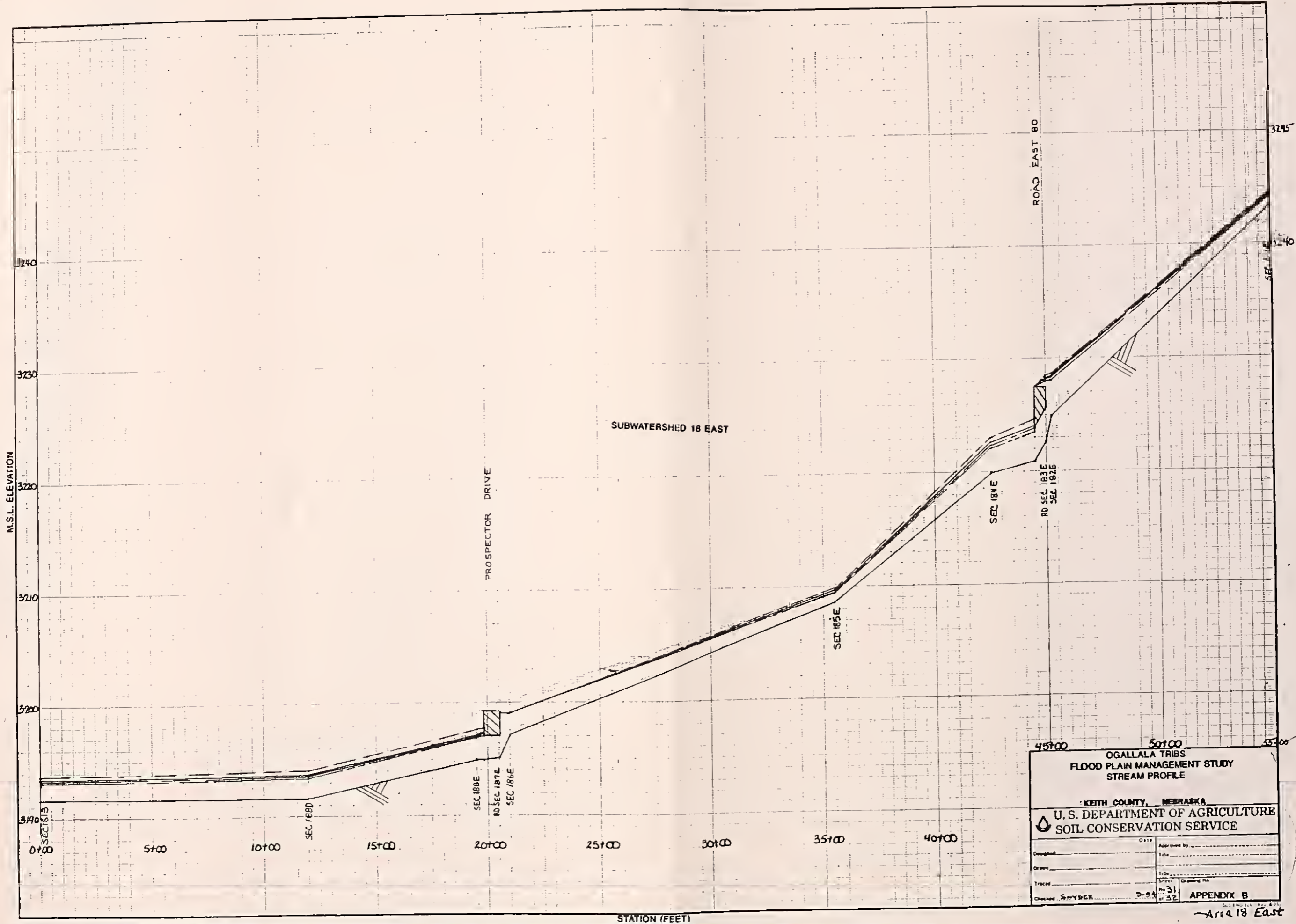
STATION (FEET)

SC-10-114 Rev. 6/75



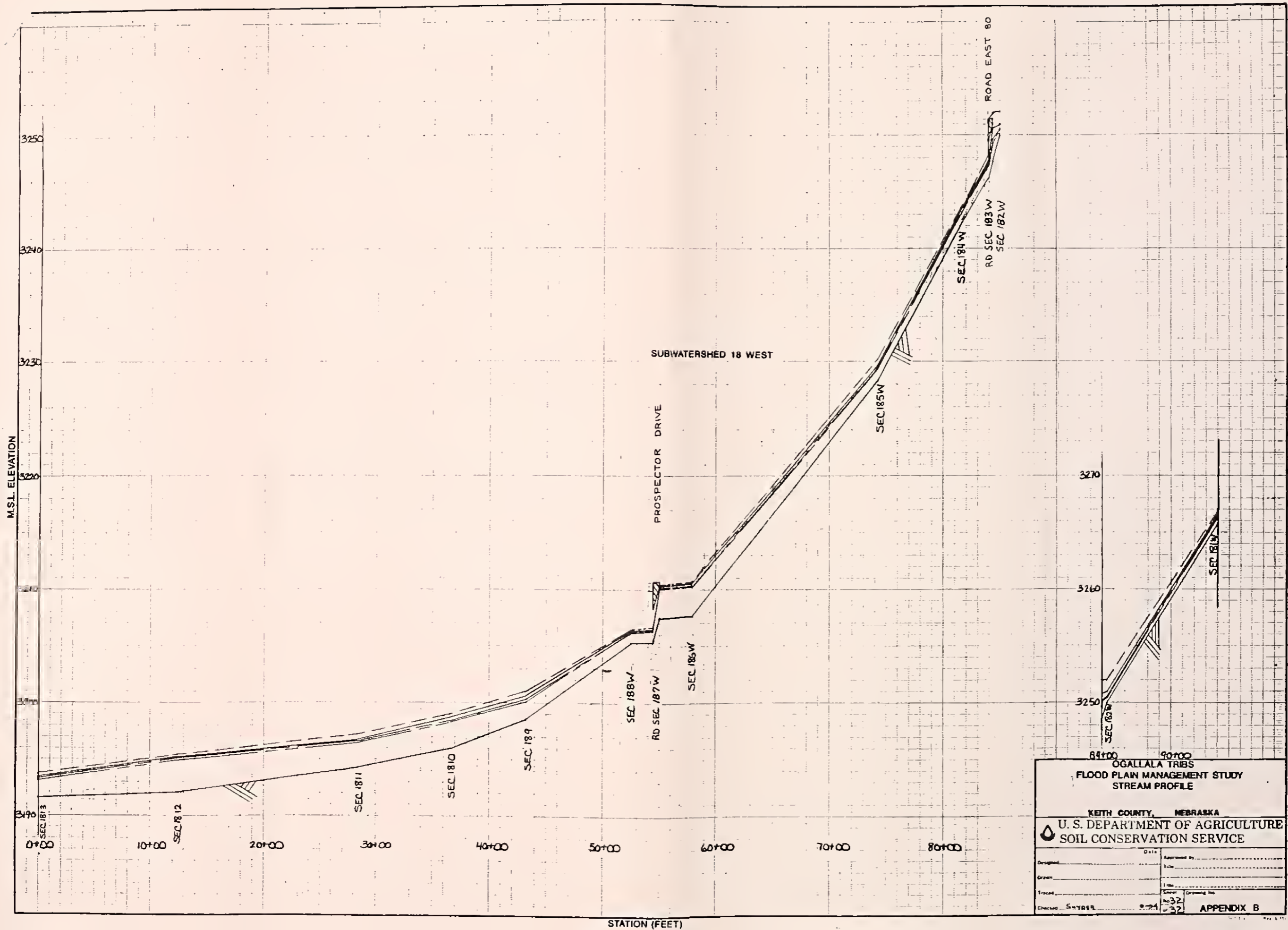
OGALLALA TRIBES FLOOD PLAIN MANAGEMENT STUDY STREAM PROFILE	
KEITH COUNTY, NEBRASKA	
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	
Designed by _____	Date _____
Drawn by _____	Approved by _____
Traced by _____	Title _____
Checked by SNYDER	Sheet 30 of 32
Drawing No. 2-34-32	
APPENDIX B	

STATION (FEET)



45+00		50+00	
OGALLALA TRIBS FLOOD PLAIN MANAGEMENT STUDY STREAM PROFILE			
KEITH COUNTY, NEBRASKA			
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE			
Date		Approved by	
Designed		Title	
Drawn		Title	
Traced		Sheet	
Checked		Drawing No.	
SYNDER		31 of 32	
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Area 18 East



OGALLALA TRIBS FLOOD PLAN MANAGEMENT STUDY STREAM PROFILE			
KEITH COUNTY, NEBRASKA			
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE			
Designed by _____ Drawn by _____ Traced by _____ Checked by <u>S. T. R. L.</u>	Date _____ Title _____ Scale _____ Drawing No. <u>32</u>	Approved by _____ Date _____ Sheet <u>32</u> of <u>32</u>	APPENDIX B

STATION (FEET)

A P P E N D I X C

T E C H N I C A L T A B L E S

CROSS SECTION NUMBER	25 YR FREQUENCY		50 YR FREQUENCY		100 YR FREQUENCY		500 YR FREQUENCY	
	DISCHARGE	ELEVATION	DISCHARGE	ELEVATION	DISCHARGE	ELEVATION	DISCHARGE	ELEVATION
	CFS		CFS		CFS		CFS	
AREA 1								
281+90 DOWNSTREAM	1530.0	3235.8	2040.0	3236.8	2550.0	3237.6	3830.0	3239.0
281+90 UPSTREAM		3236.3		3237.7		3238.7		3239.2
U28190	1530.0	3236.6	2040.0	3237.9	2550.0	3238.9	3830.0	3239.7
285+40 DOWNSTREAM	1530.0	3236.7	2040.0	3238.0	2550.0	3239.1	3830.0	3239.9
285+40 UPSTREAM		3236.7		3238.0		3239.4		3240.0
U28540	1530.0	3237.7	2040.0	3238.8	2550.0	3240.0	3830.0	3241.0
51	1530.0	3243.4	2040.0	3243.8	2550.0	3244.1	3830.0	3244.8
51+1A	1530.0	3245.8	2040.0	3246.2	2550.0	3246.3	3830.0	3246.9
52-1A	1520.0	3248.7	2030.0	3249.0	2530.0	3249.1	3800.0	3249.4
54+1A DOWNSTREAM	1510.0	3251.3	2010.0	3251.5	2520.0	3251.7	3770.0	3251.9
54+1A UPSTREAM		3252.4		3252.5		3252.6		3252.8
54+1AU	1510.0	3252.6	2010.0	3252.7	2520.0	3252.8	3770.0	3253.1
56-1D	1490.0	3254.7	1990.0	3254.8	2480.0	3255.0	3730.0	3255.4
56-1A	1490.0	3258.3	1990.0	3258.4	2480.0	3258.5	3730.0	3258.7
58+1	1490.0	3264.5	1990.0	3264.7	2480.0	3264.8	3730.0	3265.0
58+2	1350.0	3270.5	1800.0	3270.7	2250.0	3270.9	3380.0	3271.1
58+3	1280.0	3273.5	1710.0	3273.8	2140.0	3273.9	3200.0	3274.3
59-1	1240.0	3275.5	1660.0	3275.8	2070.0	3276.2	3100.0	3276.8
59	1210.0	3279.7	1610.0	3280.0	2020.0	3280.4	3020.0	3281.0
60	1200.0	3293.5	1600.0	3293.9	2000.0	3294.2	3000.0	3294.9
61	1200.0	3303.8	1590.0	3304.1	1990.0	3304.4	2990.0	3304.9
62	1160.0	3317.0	1550.0	3317.2	1940.0	3317.4	2910.0	3318.0
63	1160.0	3330.3	1540.0	3330.5	1930.0	3330.7	2890.0	3331.3
64	1100.0	3347.9	1470.0	3348.4	1840.0	3348.8	2760.0	3349.5
65	1100.0	3359.1	1460.0	3359.3	1820.0	3359.6	2740.0	3360.1
66	1090.0	3372.4	1460.0	3372.8	1820.0	3373.0	2730.0	3373.5
67	1080.0	3383.8	1430.0	3384.3	1790.0	3384.6	2690.0	3385.0
68	1060.0	3394.8	1420.0	3395.3	1780.0	3395.6	2660.0	3396.3
69	890.0	3405.9	1180.0	3406.5	1480.0	3406.9	2220.0	3407.6
70	880.0	3410.6	1180.0	3410.9	1480.0	3411.1	2210.0	3411.5
71	840.0	3411.1	1120.0	3411.4	1400.0	3411.7	2110.0	3412.2
AREA 2								
22	210.0	3271.9	280.0	3271.9	350.0	3272.0	530.0	3272.1
23	210.0	3278.3	280.0	3278.3	350.0	3278.3	530.0	3278.5
24	210.0	3285.1	280.0	3285.2	350.0	3285.3	530.0	3285.6
25	210.0	3288.8	280.0	3288.9	350.0	3289.0	530.0	3289.3
AREA 3								
316 DOWNSTREAM	480.0	3233.9	640.0	3234.9	810.0	3235.6	1230.0	3237.2
316 UPSTREAM		3234.5		3235.5		3236.4		3238.6
317D	480.0	3234.5	640.0	3235.5	810.0	3236.4	1230.0	3238.6
317 DOWNSTREAM	480.0	3234.5	640.0	3235.6	810.0	3236.5	1230.0	3238.6
317 UPSTREAM		3238.7		3240.0		3240.1		3240.3
319	480.0	3238.7	640.0	3240.0	800.0	3240.1	1220.0	3240.3
321	470.0	3238.9	620.0	3240.1	780.0	3240.2	1190.0	3240.4
322	450.0	3242.9	600.0	3243.0	760.0	3243.0	1160.0	3243.2
323	440.0	3245.1	590.0	3245.3	730.0	3245.4	1120.0	3245.5
324	430.0	3251.1	570.0	3251.2	710.0	3251.3	1090.0	3251.5
325	380.0	3257.6	510.0	3258.0	640.0	3258.2	980.0	3258.6
326	370.0	3260.2	500.0	3260.5	620.0	3260.7	950.0	3261.1

CROSS SECTION NUMBER	25 YR FREQUENCY		50 YR FREQUENCY		100 YR FREQUENCY		500 YR FREQUENCY	
	DISCHARGE	ELEVATION	DISCHARGE	ELEVATION	DISCHARGE	ELEVATION	DISCHARGE	ELEVATION
	CFS		CFS		CFS		CFS	

AREA 3 (CONTINUED)

327	360.0	3262.8	480.0	3263.0	600.0	3263.1	910.0	3263.6
320	350.0	3264.9	470.0	3265.0	580.0	3265.1	900.0	3265.2
328	350.0	3265.8	470.0	3266.0	580.0	3266.0	900.0	3266.3
329	350.0	3272.1	460.0	3272.3	580.0	3272.5	880.0	3273.0
330	340.0	3275.5	460.0	3275.8	570.0	3276.1	880.0	3276.6
331	330.0	3279.8	440.0	3280.1	560.0	3280.2	850.0	3280.9

AREA 4

419	270.0	3221.1	360.0	3221.3	450.0	3221.5	740.0	3222.0
421 DOWNSTREAM	270.0	3221.1	360.0	3221.3	450.0	3221.5	740.0	3222.0
421 UPSTREAM		3221.2		3221.4		3221.6		3222.1
422	270.0	3221.2	360.0	3221.4	450.0	3221.6	740.0	3222.1
423 DOWNSTREAM	270.0	3221.2	360.0	3221.4	450.0	3221.6	740.0	3222.1
423 UPSTREAM		3221.2		3221.5		3221.6		3222.2
424	270.0	3221.2	360.0	3221.5	450.0	3221.6	740.0	3222.2
425 DOWNSTREAM	270.0	3221.2	360.0	3221.5	450.0	3221.7	740.0	3222.2
425 UPSTREAM		3222.3		3222.4		3222.4		3222.6
426	270.0	3222.3	360.0	3222.4	450.0	3222.5	740.0	3222.6
427 DOWNSTREAM	270.0	3222.3	360.0	3222.4	450.0	3222.5	740.0	3222.7
427 UPSTREAM		3222.4		3222.5		3222.6		3222.8
428	270.0	3222.4	360.0	3222.5	450.0	3222.6	740.0	3222.9
429	260.0	3223.6	350.0	3223.7	440.0	3223.9	720.0	3224.1
430	260.0	3225.1	350.0	3225.1	440.0	3225.2	720.0	3225.4
431	260.0	3225.1	350.0	3225.2	440.0	3225.2	720.0	3225.5
432	260.0	3225.4	350.0	3225.6	440.0	3225.7	720.0	3226.0
433	150.0	3226.8	210.0	3226.9	260.0	3227.0	420.0	3227.2
434	140.0	3230.8	190.0	3231.0	240.0	3231.0	390.0	3231.2
435	130.0	3237.6	180.0	3237.7	220.0	3237.8	360.0	3238.0
420	230.0	3242.5	300.0	3242.6	370.0	3242.6	560.0	3242.8
437	220.0	3242.8	280.0	3242.9	350.0	3243.0	520.0	3243.2
438	200.0	3247.4	270.0	3247.4	330.0	3247.6	500.0	3247.7
FAN	190.0	3255.9	240.0	3255.9	300.0	3256.1	450.0	3256.1

AREA 5

515 DOWNSTREAM	310.0	3217.2	370.0	3217.5	420.0	3217.7	500.0	3218.0
515 UPSTREAM		3219.9		3220.0		3220.0		3220.1
516D	310.0	3219.9	370.0	3220.0	420.0	3220.0	500.0	3220.1
516 DOWNSTREAM	310.0	3219.9	370.0	3220.0	420.0	3220.0	500.0	3220.1
516 UPSTREAM		3220.0		3220.0		3220.1		3220.2
517D	310.0	3220.0	370.0	3220.1	420.0	3220.1	500.0	3220.2
517 DOWNSTREAM	310.0	3220.1	370.0	3220.2	420.0	3220.3	500.0	3220.4
517 UPSTREAM		3220.2		3220.3		3220.4		3220.5
523	520.0	3223.2	650.0	3223.4	810.0	3224.0	1210.0	3224.1
520	490.0	3233.9	620.0	3233.9	770.0	3234.2	1150.0	3234.4
527D	490.0	3236.2	620.0	3236.4	770.0	3236.4	1150.0	3236.6
527	360.0	3239.3	460.0	3239.3	580.0	3239.5	920.0	3239.6
521	160.0	3252.9	200.0	3252.9	260.0	3252.9	410.0	3253.0
522	160.0	3254.0	200.0	3254.0	250.0	3254.1	400.0	3254.2
529	160.0	3258.8	200.0	3258.9	250.0	3258.9	400.0	3259.3

CROSS SECTION NUMBER	25 YR FREQUENCY DISCHARGE ELEVATION CFS		50 YR FREQUENCY DISCHARGE ELEVATION CFS		100 YR FREQUENCY DISCHARGE ELEVATION CFS		500 YR FREQUENCY DISCHARGE ELEVATION CFS	
AREA 6								
617 DOWNSTREAM	40.0	3217.0	50.0	3217.1	60.0	3217.3	70.0	3217.7
617 UPSTREAM		3220.2		3220.3		3220.4		3220.5
620	120.0	3232.9	140.0	3232.9	160.0	3232.9	230.0	3233.0
622	100.0	3236.3	120.0	3236.3	140.0	3236.3	190.0	3236.4
623	80.0	3241.7	100.0	3241.8	110.0	3241.8	160.0	3241.9
624	70.0	3245.5	80.0	3245.6	90.0	3245.6	130.0	3245.7
625	50.0	3252.0	60.0	3252.0	70.0	3252.0	100.0	3252.1
626	40.0	3258.7	50.0	3258.7	60.0	3258.9	80.0	3259.1
627	30.0	3260.8	30.0	3260.8	40.0	3260.9	50.0	3261.1
AREA 7								
715 DOWNSTREAM	250.0	3212.6	270.0	3212.7	300.0	3212.8	410.0	3213.1
715 UPSTREAM		3213.3		3213.3		3213.3		3213.4
721	250.0	3213.4	270.0	3213.5	300.0	3213.6	410.0	3213.8
716 DOWNSTREAM	250.0	3213.8	270.0	3213.8	300.0	3214.0	410.0	3214.3
716 UPSTREAM		3214.1		3214.1		3214.3		3214.9
717	230.0	3214.3	290.0	3214.3	350.0	3214.5	440.0	3215.0
725	200.0	3215.2	260.0	3215.3	310.0	3215.3	400.0	3215.5
726	180.0	3217.3	230.0	3217.4	280.0	3217.5	350.0	3217.6
727	160.0	3220.5	200.0	3220.6	240.0	3220.8	300.0	3220.9
728	130.0	3223.5	170.0	3223.5	200.0	3223.7	250.0	3223.8
729	110.0	3231.4	140.0	3231.5	160.0	3231.5	210.0	3231.6
730	80.0	3235.5	100.0	3235.6	130.0	3235.7	160.0	3235.7
731	60.0	3239.4	70.0	3239.5	90.0	3239.5	110.0	3239.6
732	30.0	3243.7	40.0	3243.8	50.0	3243.8	60.0	3243.8
AREA 8								
81	130.0	3206.8	150.0	3207.0	180.0	3207.3	250.0	3207.3
82 DOWNSTREAM	130.0	3206.8	160.0	3207.0	180.0	3207.3	260.0	3207.3
82 UPSTREAM		3207.3		3207.3		3207.3		3207.3
83	130.0	3207.4	160.0	3207.4	180.0	3207.4	260.0	3207.4
84 DOWNSTREAM	130.0	3207.4	160.0	3207.4	190.0	3207.4	260.0	3207.4
84 UPSTREAM		3207.4		3207.4		3207.4		3207.4
85	130.0	3207.4	160.0	3207.5	190.0	3207.5	260.0	3207.5
86 DOWNSTREAM	140.0	3207.4	160.0	3207.5	190.0	3207.5	270.0	3207.5
86 UPSTREAM		3207.5		3207.5		3207.5		3207.5
87	140.0	3207.5	160.0	3207.6	190.0	3207.7	270.0	3207.9
88 DOWNSTREAM	140.0	3207.5	170.0	3207.6	200.0	3207.7	280.0	3207.9
88 UPSTREAM		3207.6		3207.6		3207.7		3207.9
89	140.0	3207.6	170.0	3207.6	200.0	3207.7	280.0	3208.0
810 DOWNSTREAM	140.0	3207.6	170.0	3207.6	200.0	3207.7	280.0	3208.0
810 UPSTREAM		3208.2		3208.2		3208.3		3208.4
811	140.0	3208.2	170.0	3208.3	200.0	3208.3	280.0	3208.4
812 DOWNSTREAM	140.0	3208.2	170.0	3208.3	200.0	3208.3	290.0	3208.4
812 UPSTREAM		3208.2		3208.3		3208.4		3208.5
813	140.0	3208.2	170.0	3208.3	200.0	3208.4	290.0	3208.5
814	120.0	3214.8	140.0	3214.8	170.0	3215.0	240.0	3215.1
815	100.0	3219.4	120.0	3219.6	140.0	3219.6	190.0	3219.7
816	70.0	3221.1	80.0	3221.2	100.0	3221.2	140.0	3221.3

CROSS SECTION NUMBER	25 YR FREQUENCY		50 YR FREQUENCY		100 YR FREQUENCY		500 YR FREQUENCY	
	DISCHARGE	ELEVATION	DISCHARGE	ELEVATION	DISCHARGE	ELEVATION	DISCHARGE	ELEVATION
	CFS		CFS		CFS		CFS	
AREA 8 (CONTINUED)								
817	50.0	3227.6	60.0	3227.7	70.0	3227.7	90.0	3227.8
818	30.0	3232.0	40.0	3232.0	50.0	3232.0	70.0	3232.2
819	20.0	3238.4	30.0	3238.4	30.0	3238.5	40.0	3238.6
AREA 9								
916 DOWNSTREAM	690.0	3201.0	850.0	3201.2	1040.0	3201.5	1540.0	3202.2
916 UPSTREAM		3201.0		3201.2		3201.5		3203.8
917 DOWNSTREAM	740.0	3203.2	920.0	3203.6	1120.0	3204.0	1650.0	3204.9
917 UPSTREAM		3206.5		3206.6		3206.7		3206.9
41	620.0	3219.5	770.0	3219.7	940.0	3219.8	1390.0	3220.1
42	620.0	3229.0	770.0	3229.2	940.0	3229.4	1390.0	3229.7
43	620.0	3235.7	770.0	3235.8	940.0	3236.2	1390.0	3236.9
ALONG TRACKS								
14	90.0	3202.2	160.0	3202.6	300.0	3203.1	390.0	3204.4
13	90.0	3203.0	160.0	3203.5	300.0	3204.1	390.0	3204.9
51	140.0	3203.5	240.0	3204.1	350.0	3204.5	520.0	3205.1
888	160.0	3204.9	280.0	3205.4	400.0	3205.7	600.0	3206.1
12	340.0	3207.3	440.0	3207.6	490.0	3207.7	630.0	3208.1
11	380.0	3208.3	490.0	3208.5	540.0	3208.6	700.0	3209.1
10	380.0	3209.0	500.0	3209.3	550.0	3209.4	720.0	3209.7
9	390.0	3210.4	500.0	3210.4	560.0	3210.4	730.0	3210.4
8	400.0	3212.4	510.0	3212.5	570.0	3212.5	740.0	3212.5
7	120.0	3214.0	200.0	3214.1	310.0	3214.3	713.0	3214.7
6	150.0	3218.9	180.0	3218.9	300.0	3219.1	690.0	3219.3
AREA 10								
1016D	790.0	3196.2	1040.0	3196.5	1280.0	3196.8	1920.0	3197.4
1016 DOWNSTREAM	790.0	3196.3	1040.0	3196.6	1280.0	3196.9	1920.0	3197.5
1016 UPSTREAM		3196.8		3197.4		3198.1		3199.7
1017D	790.0	3197.2	1040.0	3198.0	1280.0	3198.7	1920.0	3200.4
1017 DOWNSTREAM	790.0	3197.8	1040.0	3198.6	1280.0	3199.3	1920.0	3201.0
1017 UPSTREAM		3198.4		3199.4		3200.0		3201.6
1018	760.0	3199.1	1000.0	3199.9	1230.0	3200.4	1840.0	3202.0
1033	610.0	3201.1	790.0	3201.5	980.0	3201.9	1470.0	3202.8
1034	600.0	3203.7	780.0	3203.9	970.0	3204.1	1460.0	3204.7
1035	570.0	3212.0	740.0	3212.3	920.0	3212.6	1380.0	3213.2
1036	530.0	3218.1	700.0	3218.5	860.0	3218.8	1290.0	3219.8
1037	500.0	3226.5	660.0	3227.0	810.0	3227.5	1220.0	3228.5
1038	460.0	3236.6	610.0	3237.0	750.0	3237.5	1120.0	3238.3
1039	430.0	3253.0	570.0	3253.4	700.0	3253.7	1050.0	3254.5
AREA 11								
1110 DOWNSTREAM	260.0	3204.0	270.0	3204.0	270.0	3204.1	270.0	3204.1
1110 UPSTREAM		3204.1		3204.1		3204.1		3204.1
119	790.0	3207.0	890.0	3207.2	990.0	3207.3	1290.0	3207.6
118	790.0	3219.8	880.0	3220.0	980.0	3220.2	1280.0	3221.0
117 DOWNSTREAM	790.0	3220.2	880.0	3220.4	980.0	3220.5	1280.0	3221.3
117 UPSTREAM		3220.2		3220.4		3220.5		3221.6
116	790.0	3220.2	880.0	3220.4	980.0	3220.6	1280.0	3221.6
115	650.0	3228.7	870.0	3228.9	1080.0	3229.2	1630.0	3229.6

CROSS	25 YR FREQUENCY		50 YR FREQUENCY		100 YR FREQUENCY		500 YR FREQUENCY	
SECTION	DISCHARGE	ELEVATION	DISCHARGE	ELEVATION	DISCHARGE	ELEVATION	DISCHARGE	ELEVATION
NUMBER	CFS		CFS		CFS		CFS	

AREA 11 (CONTINUED)

114	700.0	3237.2	930.0	3237.5	1170.0	3237.9	1750.0	3238.5
113 DOWNSTREAM	710.0	3238.9	950.0	3239.3	1180.0	3239.7	1780.0	3240.4
113 UPSTREAM		3239.3		3239.3		3239.7		3240.4
112	710.0	3241.5	950.0	3241.9	1180.0	3242.2	1780.0	3242.8
111	710.0	3251.3	940.0	3251.5	1180.0	3251.8	1770.0	3252.3
72	700.0	3265.4	930.0	3265.7	1160.0	3266.0	1750.0	3266.3
73	690.0	3270.2	920.0	3270.4	1150.0	3270.7	1720.0	3271.1
74	630.0	3278.3	840.0	3278.5	1050.0	3278.8	1570.0	3279.5
75	410.0	3285.6	540.0	3285.8	680.0	3286.0	1020.0	3286.4
76	390.0	3297.0	530.0	3297.3	660.0	3297.5	990.0	3298.0
77	380.0	3311.7	510.0	3312.1	640.0	3312.4	960.0	3312.9
78	340.0	3323.8	450.0	3324.0	560.0	3324.2	840.0	3324.5

AREA 12

1310 UPSTREAM	290.0	3207.0	330.0	3207.2	370.0	3207.4	490.0	3208.2
139	290.0	3207.3	330.0	3207.5	370.0	3207.7	490.0	3208.3
138	160.0	3208.2	190.0	3208.5	210.0	3208.7	280.0	3209.0
127 DOWNSTREAM	120.0	3208.3	140.0	3208.6	160.0	3208.7	210.0	3209.1
127 UPSTREAM		3209.5		3209.8		3210.0		3210.8
1216	120.0	3209.8	140.0	3210.1	160.0	3210.3	210.0	3210.9
1215 DOWNSTREAM	130.0	3210.0	150.0	3210.3	170.0	3210.5	220.0	3211.0
1215 UPSTREAM		3210.2		3210.4		3210.6		3211.1
1214	140.0	3210.2	160.0	3210.4	180.0	3210.6	240.0	3211.1
1213 DOWNSTREAM	150.0	3210.2	170.0	3210.4	190.0	3210.6	250.0	3211.1
1213 UPSTREAM		3210.2		3210.4		3210.6		3211.1
1212	150.0	3210.3	170.0	3210.4	190.0	3210.6	250.0	3211.1
1211 DOWNSTREAM	160.0	3210.5	180.0	3210.6	200.0	3210.8	260.0	3211.2
1211 UPSTREAM		3210.5		3210.6		3210.8		3211.2
1210	160.0	3210.6	180.0	3210.7	200.0	3210.9	260.0	3211.3
129 DOWNSTREAM	170.0	3210.7	200.0	3210.7	220.0	3210.9	290.0	3211.3
129 UPSTREAM		3210.7		3210.8		3211.0		3211.3
128	170.0	3212.3	200.0	3212.3	220.0	3212.3	290.0	3212.5
126	230.0	3215.1	280.0	3215.2	350.0	3215.4	480.0	3215.6
125	170.0	3222.8	210.0	3222.8	260.0	3223.0	350.0	3223.1
124	170.0	3233.5	210.0	3233.6	260.0	3233.7	360.0	3233.9
123 DOWNSTREAM	170.0	3236.2	210.0	3236.3	260.0	3236.4	360.0	3236.4
123 UPSTREAM		3240.9		3240.9		3241.0		3241.1
122	170.0	3240.9	210.0	3241.0	260.0	3241.0	360.0	3241.1
121	170.0	3262.5	210.0	3262.7	260.0	3262.7	360.0	3262.9

AREA 13

136	190.0	3211.4	230.0	3211.5	330.0	3211.5	460.0	3211.6
1313	160.0	3212.5	200.0	3212.6	240.0	3212.7	370.0	3212.7
135	160.0	3224.9	200.0	3225.0	240.0	3225.0	370.0	3225.2
134	160.0	3234.4	210.0	3234.6	250.0	3234.7	390.0	3234.8
133 DOWNSTREAM	170.0	3238.1	220.0	3238.1	260.0	3238.1	400.0	3238.2
133 UPSTREAM		3240.1		3240.1		3240.1		3240.2
132	170.0	3240.1	220.0	3240.1	260.0	3240.1	400.0	3240.2
131	170.0	3267.6	220.0	3267.6	260.0	3267.7	400.0	3267.8

CROSS	25 YR FREQUENCY		50 YR FREQUENCY		100 YR FREQUENCY		500 YR FREQUENCY	
SECTION	DISCHARGE	ELEVATION	DISCHARGE	ELEVATION	DISCHARGE	ELEVATION	DISCHARGE	ELEVATION
NUMBER	CFS		CFS		CFS		CFS	

AREA 14

1420 DOWNSTREAM	260.0	3208.6	290.0	3208.8	320.0	3208.9	400.0	3209.3
1420 UPSTREAM		3209.4		3209.7		3209.9		3210.4
1419	260.0	3210.6	290.0	3210.8	320.0	3211.0	400.0	3211.3
1418 DOWNSTREAM	260.0	3211.0	290.0	3211.2	320.0	3211.4	400.0	3211.8
1418 UPSTREAM		3211.3		3211.5		3211.7		3212.1
1417	260.0	3211.6	290.0	3211.8	320.0	3211.9	400.0	3212.3
1416 DOWNSTREAM	260.0	3211.8	290.0	3212.0	320.0	3212.1	400.0	3212.5
1416 UPSTREAM		3211.9		3212.1		3212.2		3212.6
1415	250.0	3211.9	290.0	3212.1	310.0	3212.3	390.0	3212.7
147 DOWNSTREAM	250.0	3212.6	290.0	3212.8	310.0	3213.0	390.0	3213.4
147 UPSTREAM		3213.9		3214.4		3214.9		3216.4
1413	250.0	3213.9	290.0	3214.4	310.0	3214.9	390.0	3216.4
145E	250.0	3226.2	280.0	3226.4	310.0	3226.5	390.0	3226.8
144E	250.0	3237.7	280.0	3237.8	310.0	3237.8	390.0	3238.0
143E DOWNSTREAM	480.0	3240.0	540.0	3240.1	590.0	3240.1	740.0	3240.3
143E UPSTREAM		3242.7		3242.8		3242.9		3243.0
142E	480.0	3243.6	540.0	3243.6	590.0	3243.7	740.0	3243.8
141E	440.0	3262.3	510.0	3262.4	550.0	3262.5	690.0	3262.6
1421	400.0	3279.1	460.0	3279.1	500.0	3279.1	630.0	3279.2
1422	360.0	3283.1	410.0	3283.1	450.0	3283.3	570.0	3283.5
1423	320.0	3298.5	370.0	3298.5	400.0	3298.5	500.0	3298.6
1424	280.0	3210.5	320.0	3210.5	350.0	3210.6	440.0	3210.7
1425	360.0	3298.5	410.0	3298.5	450.0	3298.5	570.0	3298.6
1426	320.0	3215.6	370.0	3215.7	400.0	3215.7	500.0	3215.7
1427	280.0	3232.1	320.0	3232.1	350.0	3232.2	440.0	3232.3
1414 DOWNSTREAM	30.0	3213.9	40.0	3214.4	50.0	3214.9	80.0	3216.4
1414 UPSTREAM		3214.0		3214.6		3215.2		3216.9
1412	30.0	3214.0	40.0	3214.6	50.0	3215.2	80.0	3216.9
1411 DOWNSTREAM	30.0	3214.0	40.0	3214.6	50.0	3215.2	80.0	3216.9
1411 UPSTREAM		3214.0		3214.6		3215.2		3216.9
1410	30.0	3214.1	40.0	3214.6	50.0	3215.2	80.0	3216.9
149 DOWNSTREAM	30.0	3214.5	40.0	3214.7	50.0	3215.2	80.0	3216.9
149 UPSTREAM		3215.7		3216.4		3216.5		3217.0
148	30.0	3215.7	40.0	3216.4	50.0	3216.5	80.0	3217.0
145W	170.0	3223.3	220.0	3223.3	260.0	3223.5	400.0	3223.7
144W	80.0	3235.0	100.0	3235.1	120.0	3235.2	180.0	3235.3
143W DOWNSTREAM	80.0	3238.8	100.0	3238.9	120.0	3238.9	180.0	3239.0
143W UPSTREAM		3242.2		3242.3		3242.3		3242.5
142W	80.0	3242.8	100.0	3243.0	120.0	3243.0	180.0	3243.2
141W	70.0	3261.8	90.0	3261.8	110.0	3261.9	170.0	3262.1

AREA 15

1510W DOWNSTREAM	400.0	3216.1	490.0	3216.2	560.0	3216.3	670.0	3216.4
1510W UPSTREAM		3217.7		3218.2		3218.8		3219.7
159W	400.0	3217.7	490.0	3218.2	560.0	3218.8	670.0	3219.7
155	220.0	3228.8	250.0	3228.8	360.0	3229.1	610.0	3229.3
154	230.0	3235.3	270.0	3235.5	390.0	3236.0	660.0	3236.8
153 DOWNSTREAM	230.0	3239.1	270.0	3239.1	390.0	3239.6	660.0	3240.4
153 UPSTREAM		3243.4		3244.0		3244.2		3244.3
152	230.0	3243.4	270.0	3244.0	390.0	3244.2	660.0	3244.3
151	220.0	3256.6	250.0	3256.8	360.0	3257.0	610.0	3257.3

CROSS	25 YR FREQUENCY		50 YR FREQUENCY		100 YR FREQUENCY		500 YR FREQUENCY	
SECTION	DISCHARGE	ELEVATION	DISCHARGE	ELEVATION	DISCHARGE	ELEVATION	DISCHARGE	ELEVATION
NUMBER	CFS		CFS		CFS		CFS	

AREA 15 (CONTINUED)

1515	190.0	3277.6	220.0	3277.6	320.0	3277.8	540.0	3277.9
1516	160.0	3292.8	190.0	3293.0	270.0	3293.3	460.0	3293.8
1514 DOWNSTREAM	160.0	3295.8	190.0	3295.9	270.0	3296.3	460.0	3297.4
1514 UPSTREAM		3304.2		3304.3		3304.5		3304.8
1517	160.0	3304.2	190.0	3304.3	270.0	3304.5	460.0	3304.9
158W	390.0	3219.2	500.0	3219.3	560.0	3219.5	670.0	3220.0
155W	350.0	3223.8	450.0	3223.9	500.0	3223.9	600.0	3223.9
1510E DOWNSTREAM	40.0	3210.1	50.0	3210.2	60.0	3210.7	80.0	3211.5
1510E UPSTREAM		3211.3		3211.4		3212.2		3213.5
159E	40.0	3211.4	50.0	3211.5	60.0	3212.2	80.0	3213.5

AREA 16

1610 DOWNSTREAM	190.0	3220.6	200.0	3220.6	210.0	3220.6	250.0	3220.8
1610 UPSTREAM		3220.8		3220.9		3220.9		3221.2
169	190.0	3221.2	200.0	3221.3	210.0	3221.4	250.0	3221.7
165	170.0	3226.0	180.0	3226.1	190.0	3226.2	230.0	3226.4
164	480.0	3229.9	640.0	3230.3	800.0	3230.6	1200.0	3231.1
163 DOWNSTREAM	480.0	3230.7	640.0	3231.0	800.0	3231.3	1200.0	3231.8
163 UPSTREAM		3234.8		3235.6		3235.7		3235.8
162	480.0	3234.8	640.0	3235.6	800.0	3235.7	1200.0	3235.8
161	460.0	3250.4	620.0	3250.6	770.0	3250.7	1160.0	3250.9
1616	460.0	3257.4	610.0	3257.7	760.0	3258.0	1140.0	3258.6
1617	450.0	3271.3	600.0	3271.8	750.0	3272.3	1120.0	3273.2
1618	430.0	3283.3	580.0	3283.6	720.0	3283.9	1080.0	3284.5
1619	430.0	3289.1	570.0	3289.7	710.0	3290.0	1060.0	3290.7
168	230.0	3222.3	370.0	3222.5	460.0	3222.6	690.0	3222.8
165W	200.0	3223.6	320.0	3223.6	400.0	3223.8	600.0	3223.9

AREA 17

1710 DOWNSTREAM	310.0	3226.7	320.0	3226.7	330.0	3226.7	340.0	3226.8
1710 UPSTREAM		3228.1		3228.2		3228.3		3228.5
179	310.0	3228.2	320.0	3228.3	330.0	3228.3	340.0	3228.5
175	300.0	3228.2	330.0	3228.3	360.0	3228.4	430.0	3228.6
174	280.0	3236.1	370.0	3236.1	460.0	3236.2	690.0	3236.5
173 DOWNSTREAM	280.0	3238.2	370.0	3238.3	460.0	3238.4	690.0	3238.6
173 UPSTREAM		3239.7		3239.8		3239.8		3240.0
172	280.0	3240.4	370.0	3240.5	460.0	3240.5	690.0	3240.6
171	260.0	3250.4	350.0	3250.5	440.0	3250.6	660.0	3250.7
176	190.0	3228.8	260.0	3229.0	320.0	3229.1	480.0	3229.5
177	180.0	3231.8	240.0	3232.3	300.0	3232.5	450.0	3233.1

AREA 18

1813	730.0	3193.1	970.0	3193.3	1210.0	3193.4	1940.0	3193.7
1812	730.0	3194.9	970.0	3195.1	1210.0	3195.2	1940.0	3195.4
1811	730.0	3196.4	970.0	3196.6	1210.0	3196.7	1940.0	3197.2
1810	100.0	3198.3	160.0	3198.4	290.0	3198.7	700.0	3199.0
189	90.0	3200.1	140.0	3200.3	250.0	3200.6	600.0	3201.0
188W	80.0	3206.2	120.0	3206.2	220.0	3206.3	530.0	3206.4
187W DOWNSTREAM	80.0	3206.3	120.0	3206.3	220.0	3206.4	530.0	3206.6
187W UPSTREAM		3210.1		3210.2		3210.3		3210.5

CROSS SECTION NUMBER	25 YR FREQUENCY		50 YR FREQUENCY		100 YR FREQUENCY		500 YR FREQUENCY	
	DISCHARGE	ELEVATION	DISCHARGE	ELEVATION	DISCHARGE	ELEVATION	DISCHARGE	ELEVATION
	CFS		CFS		CFS		CFS	

AREA 18 (CONTINUED)

186W	80.0	3210.1	120.0	3210.2	220.0	3210.4	530.0	3210.7
185W	40.0	3229.3	60.0	3229.4	120.0	3229.7	290.0	3230.2
184W	20.0	3242.2	40.0	3242.3	60.0	3242.5	160.0	3242.9
183W DOWNSTREAM	20.0	3247.3	40.0	3247.5	60.0	3247.8	160.0	3248.3
183W UPSTREAM		3249.2		3249.6		3250.6		3251.9
182W	20.0	3250.4	40.0	3250.5	60.0	3250.9	160.0	3252.0
181W	10.0	3266.3	20.0	3266.5	40.0	3266.6	80.0	3266.8
188D	290.0	3193.4	390.0	3193.6	490.0	3193.7	780.0	3194.1
188E	290.0	3196.9	390.0	3197.1	490.0	3197.1	780.0	3197.6
187E DOWNSTREAM	290.0	3197.0	390.0	3197.2	490.0	3197.3	780.0	3197.7
187E UPSTREAM		3199.0		3199.0		3199.0		3199.0
186E	290.0	3199.0	390.0	3199.0	490.0	3199.0	780.0	3199.0
185E	290.0	3209.4	390.0	3209.5	480.0	3209.6	780.0	3209.8
184E	290.0	3222.1	380.0	3222.3	480.0	3222.6	770.0	3223.0
183E DOWNSTREAM	290.0	3223.6	380.0	3223.8	480.0	3224.0	770.0	3224.7
183E UPSTREAM		3228.0		3228.2		3228.3		3228.6
182E	290.0	3228.1	380.0	3228.3	480.0	3228.4	770.0	3228.7
181E	260.0	3244.2	340.0	3244.3	430.0	3244.5	690.0	3244.7

APPENDIX D

INVESTIGATIONS AND ANALYSES

INVESTIGATION AND ANALYSIS

Encroachment of floodplains, such as artificial barriers, reduces the water carrying capacity and increases flood heights, thus increasing flood hazards upstream of the encroachment itself. One aspect of floodplain management involves balancing the economic gain from the floodplain development against the resulting increased flood hazard.

Field surveys were made of bridges, roads, structures, and the channel and floodplain within the study area to represent the hydraulic characteristics of the stream system in 1987 (Reference 14). Surveys were made using third order accuracy. To be classed as third order accuracy, the error of closure should not be more than the product of 0.05 times the square root of the length surveyed in miles.

For the Ogallala Tributaries, 78 cross sections were surveyed by the Nebraska Natural Resources Commission (NNRC) (Reference 14). Aerial photography flown April, 1988 (Reference 15) was used to Kelch plot 13,000 acres of the watershed. Included in this 13,000 acres was all of the community of Ogallala. This plotting was done to two foot contour intervals. This Kelch plotting was used as a base for the Flood Hazard Maps used to delineate the floodplain.

Physical data was obtained from United States Geological Survey (USGS) topographic maps (Reference 16), soil survey maps (Reference 4), local topographic maps, and aerial photographs (Reference 15), as well as on-site field investigations. The watershed boundary was determined from both map studies and field checks. The watershed was divided into subwatersheds. Drainage areas for the subwatersheds were measured. Times of concentration were calculated for each of the subwatersheds.

Channel flood routings to establish peak discharge-frequency relationships were made using the Computer Program for Project Formulation Hydrology, Technical Release 20 (TR20), dated September 1, 1983 (Reference 17), and U.S. Department of Agriculture computer facilities. The Modified Attenuation-Kinematic (Att-Kin) method of routing through stream channels is used by this program. This method is derived from inflow-outflow hydrograph relationships. Several types of data were used in developing this watershed model. Drainage area, hydrologic soil groups, and land use and cover were used to develop runoff hydrographs.

Temporary flood water storage at several of the road culverts and bridges was recognized as a potential to modify downstream peak discharges. Data was gathered and evaluated. Opening sizes and type, head available from the

top of opening to top of road fill, and storage shapes were determined.

An analysis of the hydraulic characteristics of the creeks was carried out to provide stage estimates for floods of selected recurrence intervals along each of the streams. The water surface elevations (stage) were established based upon the physical elements present such as the channel size and shape, the floodplain size and shape, the bridge sizes and shapes, and the Manning's roughness coefficients (Reference 18). The hydraulic computations were made using the SCS Hydraulic Model WSP-2, Technical Release 61 (TR61) (Reference 19). This model employs the standard step method for backwater profiles. The method involves a computational procedure which estimates total energy at each stream cross section and accounts for friction losses between sections. The bridge effects on stream hydraulics were accounted for in TR61 using the Bureau of Public Roads (BPR) Method (Reference 20). The bridge method has been formulated by the principle of conservation of energy between the point of maximum backwater upstream from the bridge and a point downstream from the bridge at which normal stage has been established. The culverts were evaluated by the principle of conservation of energy and consideration of the depth of headwater and tailwater, the barrel shape and cross-sectional areas, the type of inlet, and shape of headwall.

In the hydraulic analysis of subwatershed 4, the Federal Emergency Management Agency (FEMA) Alluvial Fan model was used. This model is "FAN - An Alluvial Fan Flooding Computer Program" dated September 1990 (Reference 23). Due to the uniqueness of this area, it was recommended that the width of the floodplain be analyzed using FEMA's computer model. This was performed under the guidance of John Liou, Federal Emergency Management Agency Hydraulic Engineer, Boulder, Colorado. The area south of the existing dam in subwatershed 4 and north of west Fifth Street was the area analyzed using the FAN model.

Economic analysis was performed by the use of the ECON-2 computer program (Reference 21). This includes the determination of crop and pasture, other agriculture and non-agricultural damages. Basically, three types of input data are required: economic, hydraulic and hydrologic related data.

The ECON-2 program is designed to use hydraulic and hydrologic data from flood routing as part of the input data. It can be used, therefore, to appraise floodwater damages when the acres flooded have been determined. The program computes the average annual damages to crops and pasture where floodwater damages can be related to flood depths or elevations. Some types of damage such as damage to the land from voiding through gully encroachment or bank

caving, and deposition of sediment have not been included in the program. These types of damages often are not correlated directly with flood peaks and their causal factors are not subject to hydrologic analysis.

For the economic input section of ECON-2, several processes need to be completed. The major tasks are determining the crop distribution, crop yields, and the composite acre value of land use for each reach in the floodplain.

The method used for determining crop distribution in each reach of the floodplain was to secure recent aerial photographs and make a detailed inspection of the photographs. With the use of the aerial photographs an estimation was made of the acres of pasture, cropland and miscellaneous land uses in each one half section that the creek ran through. The percentages of crops irrigated and the kinds and percentages of crops grown were determined by field inspection and by using Nebraska Agricultural Statistics county data (Reference 22).

After the crop distribution is determined, it is displayed by reach for the ECON-2 program. There are certain economic factors that are considered in determining the length of a reach to be studied and the number of cross sections within this reach. Some of the economic factors

are the uniformity of the crop distribution, the fertility and width of the floodplain, and the total value of a floodplain acre. Ordinarily, if crops and values subject to damage do not differ significantly and there is no localized effect of a structural measure, such as channel improvement, several cross sections can be combined into one evaluation reach for damage analysis.

Crop yields were determined by using two general sources: (1) Nebraska Agricultural Statistics data (Reference 22), and (2) SCS Soil Survey (Reference 4). Specific soils in the floodplains were identified. Crop yields were weighted according to the percentage of those soils in Keith County.

A five-year county average yield was calculated from Nebraska Agricultural Statistics. These county average yields were then adjusted for floodplain yields by applying a ratio derived from the differences between floodplain soil yields and whole county average soil yields in the SCS published soil surveys.

Crop prices for ECON-2 are obtained from the United States Department of Agriculture. The crop prices are derived by using information obtained from a structural econometric model of the agricultural sector as well as inputs from commodity specialists in the Economic Research

Service. The simulation model procedure was used to minimize short-run distortions in market prices caused by such factors as abnormal weather patterns and short-term fluctuations in the foreign demand for agricultural products. Commodity specialists then used the model results to derive consistent commodity prices and indices for those commodities not included in the simulation model.

Considering the crop distribution in the floodplain, the average yields of the crops, and current normalized prices, a composite damageable value per acre of floodplain is determined.

Damage factors for ECON-2 are derived for each crop. The month of the growing season and the depth of flooding are both considered in deriving the factors. The depth of water is given in these ranges: 0-1 feet, 1-3 feet, and any depth greater than three feet. The percent damage to a given crop at each depth increment of flooding during a given month is used by the computer. The damage factors used allow for normal duration of flooding, but in some cases additional duration of flooding should be considered. Where this is the case, an adjustment in the basic damage factor to account for the added duration can be made.

The crop damage factors are given by month because at different times of the year the crops are more susceptible to damage from flooding than during other months. For example, six inches of water in May or June causes more damage to corn than six inches in August when the corn is more mature.

The damage is expressed as a percentage of the gross value (price times yield) of the crop if it were undamaged. Included in the damage calculation is the physical loss in yield together with any reduction in value per unit, plus additional production costs incurred, minus expenses saved, such as harvesting, hauling, and storing. The theoretical basis for this approach is that when a farmer reserves part of his land for a given crop, he has done so with the expectation of obtaining a certain return based upon yield, price, and normal production expenses. A flood which affects any of these factors unfavorably will reduce his net income.

Included in the ECON-2 input data is the percent chance of floods and the storm series. The data lists the percent chance of occurrence of the largest storm first and other evaluated storms will be listed in descending order.

The seasonal distribution of floods is also taken into account when making economic evaluations. This is necessary

because of the difference in flood damage resulting from given flood stages during different periods of plant growth. The flood distribution refers to the percent of the total number of floods for a given year that occur in the months the soil is not frozen.

A P P E N D I X E

E L E V A T I O N B E N C H M A R K S

Project: OGALLALA TRIBS Date: 1975
Bench Mark No. TT 2 HCO RESET County:KEITH
Elevation: 3408.621 Quad. OGALLALA
Book No. Page No. Section:30 14N 38W
U.S. G.S. BRASS CAP 2.3 MI. SOUTH OF JCT. U.S. HWY.#26 AND STATE HWY.#61
ABOUT .15 MI. NORTH OF CENTER OF SEC. 30; 636FT. NORTH AND 80FT. EAST OF RD.
AT FENCE WEST; 11.5FT. SOUTH OF POWER POLE IN CONCRETE POST.

Project: OGALLALA TRIBS Date: 1938
Bench Mark No. K 8 RESET 1938 County:KEITH
Elevation: 3214.261 Quad. OGALLALA SOUTHWEST
Book No. Page No. Section:CITY OF OGALLALA
U.S. G.S. BRASS CAP ABOUT 300FT. WEST OF THE UNION PACIFIC RAILROAD STATION,
AT BRIDGE 334.92 AND IN THE SOUTHWEST CORNER OF THE WEST BACK WALL OF
BRIDGE.

Project: OGALLALA TRIBS Date: 1963
Bench Mark No. OGALLALA RESET 1963 County:KEITH
Elevation: 3223.475 Quad. OGALLALA
Book No. Page No. Section:CITY OF OGALLALA
U.S. G.S. BRASS CAP AT THE INTERSECTION OF 5TH AND SPRUCE STREETS IN
OGALLALA 39.8FT. NORTH OF 5TH STREET AND 40.2FT. EAST OF THE CENTERLINE OF
SPRUCE STREET.

Project: OGALLALA TRIBS Date: 1933
Bench Mark No. M 8 County:KEITH
Elevation: 3249.039 Quad. BRULE SOUTHEAST
Book No. Page No. Section:17 13N 39W
U.S. G.S. BRASS CAP ABOUT 4.8 MILES WEST ALONG THE UNION PACIFIC RAILROAD
FROM OGALLALA AT A PRIVATE ROAD CROSSING 96FT. SOUTH OF THE CENTERLINE OF
U.S. HWY. #30, 52FT. WEST OF CENTER LINE OF ROAD 12FT. WEST OF A POLE.

Project: OGALLALA TRIBS Date: 1933
Bench Mark No. J 8 County:KEITH
Elevation: 3200.489 Quad. OGALLALA
Book No. Page No. Section:4 13N 38W
U.S. G.S. BRASS CAP ABOUT 1.7 MI. EAST ALONG UNION PACIFIC RAILROAD 3 POLES
WEST OF MILE POST 333, 26FT. FROM CENTER OF ROAD CROSSING 200FT. SOUTH OF
CENTERLINE HWY.#30, 79FT. SOUTH OF THE SOUTH RAIL OF THE SOUTH MAIN TRACK.

Project: OGALLALA TRIBS Date: 1972
Bench Mark No. B 160 RESET 1972 County:KEITH
Elevation: 3423.254 Quad. OGALLALA SOUTHWEST
Book No. Page No. Section:30 13N 38W
3.9 MILES SOUTH ALONG HWY.#61 FROM OGALLALA, ABOUT 1/2 MILE SOUTH OF A
FARMHOUSE, 45FT. WEST OF THE CENTERLINE OF THE HWY. 42FT. SOUTH OF A FENCE

OGALLALA TRIBS

BM'S

***** NOTE ALL BENCHES ARE IN CITY OF OGALLALA*****

BM-A 3215.066 Bk.1-Pg.35	Chisled cross in NE corner of sidewalk at SW corner of intersection of West 2nd and West 'B' Streets.
BM-B 3221.060 Bk.1-Pg.35	Top of fire hydrant at NE corner of intersection of West 3rd and West 'B' Streets.
BM-C 3221.770 Bk.1-Pg.35	Top of Water Meter cover at NE corner of intersection of West 4th and West 'B' Streets.
BM-D 3227.461 Bk.1-Pg.35	Top of fire hydrant at NE corner of West 5th Street and West 'B' Street.
BM-E 3233.381 Bk.1-Pg.35	Top of fire hydrant at NW corner of West 7th Street and West 'B' Street.
BM-F 3236.141 Bk.1-Pg.35	Chisled cross in SE corner of bottom step at SW corner of West 8th and West 'B' Streets.
BM-G 3243.115 Bk.1-Pg.35	Top of fire hydrant at NW corner of West 9th Street and West 'B' Street.
BM-H 3244.004 Bk.1-Pg.35	Chisled cross in NE corner of headwall at SW corner of West 10th and West 'B' Streets.

Project: OGALLALA TRIBBS Date : 11-01-86
Bench Mark No. BM-DR-OT-A County: KEITH
Elevation: 3215.066 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 35 Section: CITY OF OGALLALA
CHISELED CROSS IN THE N.E. CORNER OF SIDEWALK AT S.W. CORNER OF INTERSECTION
OF WEST 2ND AND B STREETS.

Project: OGALLALA TRIBBS Date : 11-01-86
Bench Mark No. BM-DR-OT-B County: KEITH
Elevation: 3221.060 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 35 Section: CITY OF OGALLALA
TOP OF FIRE HYDRANT AT THE N.E. CORNER OF INTERSECTION OF WEST 3RD AND WEST
B STREETS.

Project: OGALLALA TRIBBS Date : 11-01-86
Bench Mark No. BM-DR-OT-C County: KEITH
Elevation: 3221.770 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 35 Section: CITY OF OGALLALA
TOP OF WATER METER COVER AT THE N.E. CORNER OF INTERSECTION OF WEST 4TH AND
WEST B STREETS.

Project: OGALLALA TRIBBS Date : 11-01-86
Bench Mark No. BM-DR-OT-D County: KEITH
Elevation: 3227.461 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 35 Section: CITY OF OGALLALA
TOP OF FIRE HYDRANT AT THE N.E. CORNER OF WEST 5TH AND WEST B STREETS.

Project: OGALLALA TRIBBS Date : 11-01-86
Bench Mark No. BM-DR-OT-E County: KEITH
Elevation: 3233.381 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 35 Section: CITY OF OGALLALA
TOP OF FIRE HYDRANT AT THE N.W. CORNER OF WEST 7TH AND WEST B STREETS.

Project: OGALLALA TRIBBS Date : 11-01-86
Bench Mark No. BM-DR-OT-F County: KEITH
Elevation: 3236.141 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 35 Section: CITY OF OGALLALA
CHISELED CROSS IN THE S.E. CORNER OF WEST 8TH STREET AND WEST B STREETS.

Project: OGALLALA TRIBBS
Bench Mark No. BM-DR-OT-G
Elevation: 3243.115
Book No. 1 Page No. 35
Date : 11-01-86
County: KEITH
Quad. OGALLALA SOUTHWEST
Section: CITY OF OGALLALA
TOP OF FIRE HYDRANT AT THE N.W. CORNER OF WEST 9TH STREET AND WEST B
STREETS.

Project: OGALLALA TRIBBS
Bench Mark No. BM-DR-OT-H
Elevation: 3244.004
Book No. 1 Page No. 35
Date : 11-01-86
County: KEITH
Quad. OGALLALA SOUTHWEST
Section: CITY OF OGALLALA
CHISLED CROSS IN THE N.E. CORNER OF HEADWALL AT S.W. CORNER OF WEST 10TH AND
WEST B STREETS.

Project: OGALLALA TRIBBS
Bench Mark No. BM-DR-OT-1
Elevation: 3408.383
Book No. 1 Page No. 13
Date : 11-86
County: KEITH
Quad. BRULE NORTHEAST
Section: 29-14N-39W
TOP OF RAILROAD SPIKE IN THE WEST FACE OF SOUTH CROSS MEMBER OF SMALL COUNTY
BRIDGE OVER OGALLALA GULCH AND ON THE EAST SIDE OF SECTION.

Project: OGALLALA TRIBBS
Bench Mark No. BM-DR-OT-2
Elevation: 3243.364
Book No. 1 Page No. 16
Date : 11-86
County: KEITH
Quad. BRULE SOUTHEAST
Section: 9-13N-39W
PUNCHED HOLE IN THE TOP AND WEST END OF 48 INCH C.M.P. AT THE NORTHWEST
CORNER OF INTERSECTION AND ON THE EAST SIDE OF THE S.E. 1/4 OF THE S.E. 1/4
OF SECTION.

Project: OGALLALA TRIBBS
Bench Mark No. BM-DR-OT-3
Elevation: 3238.421
Book No. 1 Page No. 17
Date : 11-86
County: KEITH
Quad. BRULE SOUTHEAST
Section: 10-13N-39W
CHISELED CROSS IN THE TOP AND SOUTH END OF HEADWALL OF CULVERT AND ON THE
EAST SIDE OF THE S.E. 1/4 OF N.E. 1/4 OF SECTION.

Project: OGALLALA TRIBBS
Bench Mark No. BM-DR-OT-4
Elevation: 3239.558
Book No. 1 Page No. 18
Date : 11-86
County: KEITH
Quad. BRULE SOUTHEAST
Section: 11-13N-39W
CHISELED CROSS IN THE S.E. CORNER OF THE SOUTH HEADWALL OF CULVERT JUST EAST
OF THE 1/2 MILE LINE AND IN THE N.W. 1/4 OF THE N.E. 1/4 OF SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-5 County: KEITH
Elevation: 3240.379 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 18 Section: 1-13N-39W
CHISELED CROSS IN THE CENTER OF THE EAST HEADWALL OF CULVERT AND IN THE S.W.
CORNER OF SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-6 County: KEITH
Elevation: 3222.117 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 18 Section: 1-13N-39W
CHISELED CROSS IN THE S.E. CORNER OF SOUTH HEADWALL OF CULVERT S.E. OF PCA
BUILDING AND IN THE S.W. 1/4 OF THE S.E. 1/4 OF SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-7 County: KEITH
Elevation: 3211.550 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 20 Section: 6-13N-38W
TOP AND WEST END OF SOUTH DRAIN SPOUT OF OVERPASS SOUTH OF ROAD AND IN THE
N.W. 1/4 OF THE S.E. 1/4 OF SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-8 County: KEITH
Elevation: 3224.794 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 20 Section: 7-13N-38W
CHISELED CROSS IN TOP AND NORTH EAND OF EAST BANNISTER OF STATE BRIDGE
#14891 OVER SOUTH PLATTE RIVER AND ON THE NORTH SIDE OF N.E. 1/4 OF THE N.E.
1/4 OF SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-9 County: KEITH
Elevation: 3224.346 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 20 Section: 7-13N-38W
TOP OF S.E. BOLT IN THE WEST LIGHT POLE BASE AT THE SOUTH ENTRANCE TO TEXACO
STATION AND IN S.E. 1/4 OF NE 1/4 OF SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-10 County: KEITH
Elevation: 3207.010 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 21 Section: 9-13N-38W
CHISELED CROSS IN THE TOP AND EAST END OF NORTH HEADWALL AND ON THE WEST
SIDE OF THE N.W. 1/4 OF THE N.W. 1/4 OF SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-11 County: KEITH
Elevation: 3182.882 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 23 Section: 10-13N-38W
PUNCHED HOLE IN THE TOP AND WEST END OF 48 INCH CMP ON THE 1/4 MILE LINE AND
ON THE EAST SIDE OF SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-12 County: KEITH
Elevation: 3241.482 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 26 Section: 7-13N-38W
CHISELED CROSS IN THE N.W. CORNER OF THE NORTH HEADWALL OF CULVERT AND ON
THE SOUTH SIDE OF THE S.W. 1/4 OF THE S.E. 1/4 OF SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-13 County: KEITH
Elevation: 3317.252 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 27 Section: 18-13N-38W
TOP AND N.E. CORNER OF CONCRETE R.O.W. MARKER POST ON THE MILE LINE AND IN
THE S.E. CORNER OF THE S.E. 1/4 OF THE S.W. 1/4 SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-14 County: KEITH
Elevation: 3221.147 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 29 Section: 7-13N-38W
TOP OF FIRE HYDRANT AT WEST EDGE OF PARKING AREA AT ENTRANCE TO SUPER 8
MOTEL AND SERVICE STATIONS AND IN THE N.W. 1/4 OF THE S.E. 1/4 OF SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-15 County: KEITH
Elevation: 3210.944 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 29 Section: 7-13N-38W
CHISELED CROSS IN TOP AND SOUTH END OF EAST CURB OF CULVERT AT S.E. CORNER
OF TRUCK STOP AND IN THE S.E. CORNER S.E. 1/4 OF THE N.E. 1/4 OF SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-16 County: KEITH
Elevation: 3220.041 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 30 Section: 8-13N-38W
RAILROAD SPIKE IN THE N.E. PILING OF S.W. WINGWALL OF SMALL COUNTY BRIDGE
AND IN THE N.E. CORNER OF N.E. 1/4 OF THE S.E. 1/4 OF SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-17 County: KEITH
Elevation: 3209.824 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 30 Section: 9-13N-38W
CHISELED CROSS IN CENTER OF SOUTH HEADWALL OF CULVERT AND ON THE NORTH SIDE
OF THE N.E. 1/4 OF THE S.W. 1/4 OF SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-18 County: KEITH
Elevation: 3197.171 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 31 Section: 9-13N-38W
CHISELED CROSS IN THE TOP AND NORTH END OF A 24 INCH CONCRETE TUBE AND IN
THE S.E. CORNER ON THE S.E. 1/4 OF THE N.E. 1/4 OF SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-19 County: KEITH
Elevation: 3235.444 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 32 Section: 13-13N-38W
CHISELED CROSS IN THE TOP AND S.W. CORNER ON SOUTH HEADWALL AND ON THE NORTH
SIDE OF N.W. 1/4 OF THE N.E. 1/4 OF SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-20 County: KEITH
Elevation: 3240.762 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 34 Section: 7-13N-38W
PUNCHED HOLE IN THE TOP AND NORTH END OF WEST 48 INCH CMP AND ON THE SOUTH
SIDE OF THE S.W. 1/4 OF THE S.W. 1/4 OF SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-21 County: KEITH
Elevation: 3216.146 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 35 Section: 6-13N-38W
TOP OF FIRE HYDRANT AT N.W. CORNER OF INTERSECTION OF WEST 1ST. AND WEST B
STREET. CITY OF OGALLALA.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-22 County: KEITH
Elevation: 3232.224 Quad. OGALLALA
Book No. 1 Page No. 37 Section: 6-13N-38W
TOP OF FIRE HYDRANT AT THE N.E. CORNER OF WEST 5TH STREET AND WEST H STREET
AND ON THE 1/2 MILE LINE AND ON THE WEST SIDE OF SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-23 County: KEITH
Elevation: 3235.893 Quad. OGALLALA
Book No. 1 Page No. 37 Section: 1-13N-39W
TOP OF FIRE HYDRANT AT N.W. CORNER OF WEST 5TH STREET AND WEST L STREET AND
ON THE SOUTH SIDE OF THE S.E. 1/4 OF THE N.E. 1/4 OF SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-24 County: KEITH
Elevation: 3240.443 Quad. OGALLALA
Book No. 1 Page No. 37 Section: 1-13N-39W
TOP OF FIRE HYDRANT AT THE S.E. CORNER OF WEST 5TH AND WEST P STREETS AND
APPROX. IN CENTER OF SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-25 County: KEITH
Elevation: 3259.080 Quad. OGALLALA
Book No. 1 Page No. 40 Section: 1-13N-39W
TOP OF FIRE HYDRANT AT NORTH SIDE OF ETHEL AVE. AND WEST END OF PAVED STREET
AND IN THE N.E. 1/4 OF THE N.E. 1/4 OF SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-26 County: KEITH
Elevation: 3200.915 Quad. OGALLALA
Book No. 3 Page No. 6 Section: 4-13N-38W
CHISELED CROSS IN THE WEST END OF SOUTH HEADWALL OF CULVERT AND IN THE N.E.
1/4 OF SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-27 County: KEITH
Elevation: 3200.143 Quad. OGALLALA
Book No. 3 Page No. 7 Section: 4-13N-38W
A CHISELED CROSS AT THE WEST END OF THE SOUTH HEADWALL OF THE CULVERT AND ON
THE EAST SIDE OF THE N.E. 1/4 OF THE N.E. 1/4 OF SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-28 County: KEITH
Elevation: 3203.034 Quad. OGALLALA
Book No. 3 Page No. 9 Section: 3-13N-38W
A CHISELED CROSS IN THE CENTER OF THE SOUTH HEADWALL OF THE CULVERT AND IN
THE N.E. 1/4 OF THE N.E. 1/4 OF SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-29 County: KEITH
Elevation: 3204.301 Quad. OGALLALA
Book No. 3 Page No. 11 Section: 5-13N-38W
A CHISELED CROSS IN THE EAST END OF THE SOUTH HEADWALL OF THE CULVERT AND ON
THE EAST SIDE OF THE NORTHEAST 1/4 OF SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-30 County: KEITH
Elevation: 3205.762 Quad. OGALLALA
Book No. 3 Page No. 12 Section: 5-13N-38W
A CHISELED CROSS IN THE TOP AND EAST END OF THE SOUTH ROUND CONCRETE CULVERT
ON THE 1/2 MILE LINE IN SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-31 County: KEITH
Elevation: 3213.305 Quad. OGALLALA
Book No. 3 Page No. 14 Section: 6-13N-38W
TOP OF FIRE HYDRANT AT THE NORTHWEST CORNER ON EAST 1ST AND EAST G STREETS
AND ON THE EAST SIDE OF SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-32 County: KEITH
Elevation: 3227.776 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 41 Section: 12-13N-39W
A CHISELED CROSS IN THE SOUTHEAST CORNER OF THE HEADWALL OF THE CULVERT
UNDER I-80 AND ON THE WEST SIDE OF THE N.W. 1/4 OF THE S.W. 1/4 OF SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-33 County: KEITH
Elevation: 3212.797 Quad. OGALLALA SOUTHWEST
Book No. 2 Page No. 63 Section: 7-13N-39W
A CHISELED CROSS IN THE TOP AND SOUTH END OF A 4 1/2 FOOT ROUND CONCRETE
CULVERT UNDER I-80 AND IN THE S.W. 1/4 OF THE N.E. 1/4 OF SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-34 County: KEITH
Elevation: 3312.223 Quad. OGALLALA SOUTHWEST
Book No. 6 Page No. 30 Section: 21-13N-38W
TOP OF 2 INCH STEEL PIPE AT BASE OF OLD WINDMILL AND ON THE RIGHT BANK AND
IN THE N.E. 1/4 OF THE S.W. 1/4 OF SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-35 County: KEITH
Elevation: 3223.147 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 42 Section: 12-13N-39W
CHISELED CROSS IN THE WEST END OF THE SOUTH HEADWALL OF CULVERT #12540 AND
IN APPROXIMATE CENTER OF SECTION.

Project: OGALLALA TRIBBS Date : 11-86
Bench Mark No. BM-DR-OT-36 County: KEITH
Elevation: 3217.674 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 44 Section: 12-13N-39W
CHISELED CROSS IN THE TOP OF A 3 1/2 FOOT ROUND CONCRETE CULVERT AND ON THE
EAST SIDE OF THE N.E. 1/4 OF THE N.E. 1/4 SECTION.

Project: OGALLALA TRIBBS Date : 5-88
Bench Mark No. BM-DR-OT-37 County: KEITH
Elevation: 3211.710 Quad. OGALLALA SOUTHWEST
Book No. 10 Page No. 50 Section: 7-13N-38W
CHISELED CROSS IN THE TOP AND NORTH END OF CONCRETE CULVERT EAST OF SALVAGE
YARD AND IN THE S.W. 1/4 OF THE N.E. 1/4 OF SECTION.

Project: OGALLALA TRIBBS
Bench Mark No. BM MD OT 1
Elevation: 3243.579

Date : 5-88
County: KEITH
Quad. BRULE S.E.

Book No. 8 Page No. 55 Section: 11-13N-39W

A CHISELED CROSS ON THE NORTHWEST CORNER OF A CONCRETE PAD FOR CITY OF
OGALLALA AIRPORT FIRE WELL AT ENTRANCE TO AIRPORT AND ON 1/2 MILE LINE NORTH
SIDE OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-1 County: KEITH
Elevation: 3267.595 Quad. BRULE SOUTHEAST
Book No. 1 Page No. 5 Section: 9-13N-39W
HEAD OF TOP SPIKE IN THE S.W. FACE OF A POWER POLE ON THE 1/2 MILE
LINE AND ON THE WEST SIDE OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-2 County: KEITH
Elevation: 3287.559 Quad. BRULE SOUTHEAST
Book No. 1 Page No. 5 Section: 9-13N-39W
HEAD OF TOP SPIKE IN THE N.W. FACE OF A CORNER POST IN THE N.W.
CORNER OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-3 County: KEITH
Elevation: 3334.506 Quad. BRULE NORTHEAST
Book No. 1 Page No. 7 Section: 5-13N-39W
HEAD OF TOP SPIKE IN THE EAST FACE OF A CORNER POST ON THE 1/2 MILE
LINE AND ON THE EAST SIDE OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-4 County: KEITH
Elevation: 3375.980 Quad. BRULE NORTHEAST
Book No. 1 Page No. 8 Section: 4-13N-39W
HEAD OF TOP SPIKE IN THE S.W. FACE OF A CORNER POST IN THE N.W.
CORNER OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-5 County: KEITH
Elevation: 3499.039 Quad. BRULE NORTHEAST
Book No. 1 Page No. 12 Section: 33-14N-39W
HEAD OF TOP SPIKE IN THE S.W. FACE OF LONE POLE ON THE 1/2 MILE LINE
AND ON THE WEST SIDE OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-6 County: KEITH
Elevation: 3489.519 Quad. BRULE NORTHEAST
Book No. 1 Page No. 12 Section: 29-14N-39W
HEAD OF TOP SPIKE IN THE N.E. FACE OF A CORNER POST IN THE S.E.
CORNER OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-7 County: KEITH
Elevation: 3502.033 Quad. BRULE NORTHEAST
Book No. 1 Page No. 12 Section: 28-14N-39W
HEAD OF TOP SPIKE IN THE WEST FACE OF A CORNER POST ON THE 1/4 MILE
LINE AND ON THE WEST SIDE OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-8 County: KEITH
Elevation: 3245.372 Quad. BRULE SOUTHEAST
Book No. 1 Page No. 16 Section: 9-13N-39W
HEAD OF TOP SPIKE IN THE SOUTH FACE OF A CORNER POST ON THE 1/2 MILE
LINE AND IN THE NORTH R.O.W. AND ON THE EAST SIDE OFF S.E. 1/4 OF THE
S.W. 1/4 SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-9 County: KEITH
Elevation: 3245.454 Quad. BRULE SOUTHEAST
Book No. 1 Page No. 17 Section: 10-13N-39W
HEAD OF TOP SPIKE IN THE SOUTH FACE OF A CORNER POST ON THE 1/2 MILE
LINE AND IN THE NORTH R.O.W. AND ON THE EAST SIDE OF THE N.E. 1/4 OF
THE S.W. 1/4 OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-10 County: KEITH
Elevation: 3244.130 Quad. BRULE SOUTHEAST
Book No. 1 Page No. 18 Section: 11-13N-39W
HEAD OF TOP SPIKE IN THE S.E. FACE OF A CORNER POST IN THE NORTH
R.O.W. AND ON THE NORTH SIDE OF THE N.E. 1/4 OF THE N.E. 1/4 OF
SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-11 County: KEITH
Elevation: 3223.792 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 18 Section: 1-13N-39W
TOP OF RAILROAD SPIKE IN THE NORTH FACE OF POWER POLE ON THE 1/2 MILE
LINE AND IN THE S.E. 1/4 S.E. 1/4 S.W. 1/4 OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-12 County: KEITH
Elevation: 3208.807 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 21 Section: 8-13N-38W
HEAD OF TOP SPIKE IN THE NORTH FACE OF A POWER POLE ON THE 1/2 MILE
LINE AND IN THE NORTH I-80 R.O.W. AND IN THE N.E. 1/4 N.W. 1/4
SECTION

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-13 County: KEITH
Elevation: 3196.536 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 21 Section: 4-13N-38W
HEAD OF TOP SPIKE IN THE SOUTH FACE OF A CORNER POST ON THE 1/2 MILE
LINE AND ON THE SOUTH SIDE OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-14 County: KEITH
Elevation: 3193.394 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 22 Section: 3-13N-38W
HEAD OF TOP SPIKE IN THE S.W. FACE OF A POWER POLE IN THE NORTH
R.O.W. AND ON THE WEST SIDE OF THE S.W. 1/4 S.W. 1/4 OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-15 County: KEITH
Elevation: 3187.879 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 22 Section: 3-13N-38W
HEAD OF TOP SPIKE IN THE SOUTH FACE OF A CORNER POST ON THE 1/2 MILE
LINE AND ON THE EAST SIDE OF S.E. 1/4 OF THE S.W. 1/4 SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-16 County: KEITH
Elevation: 3182.812 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 22 Section: 3-13N-38W
HEAD OF TOP SPIKE IN THE S.W. FACE OF A FENCE POST JUST SOUTH OF
TRANSFORMER POLE AND IN THE S.E. 1/4 OF THE S.E. 1/4 OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-17 County: KEITH
Elevation: 3183.514 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 23 Section: 3-13N-38W
HEAD OF TOP SPIKE IN THE S.E. FACE OF A CORNER POST IN THE SOUT I-80
R.O.W. WEST OF OVERPASS AND IN THE S.E. CORNER OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-18 County: KEITH
Elevation: 3186.033 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 23 Section: 10-13N-38W
HEAD OF TOP SPIKE IN THE S.E. FACE OF A POWER POLE ON THE 1/2 MILE
LINE AND ON THE EAST SIDE OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-19 County: KEITH
Elevation: 3220.751 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 23 Section: 10-13N-38W
HEAD OF TOP SPIKE IN THE S.E. FACE OF A POWER POLE ON THE 1/4 MILE
LINE AND ON THE EAST SIDE OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-20 County: KEITH
Elevation: 3232.988 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 24 Section: 15-13N-38W
HEAD OF TOP SPIKE IN THE N.E. FACE OF POWER POLE IN THE N.E. CORNER
SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-21 County: KEITH
Elevation: 3229.260 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 24 Section: 15-13N-38W
HEAD OF TOP SPIKE IN THE NORTH FACE OF A TRANSFORMER POLE ON THE 1/2
MILE LINE AND ON THE NORTH SIDE OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-22 County: KEITH
Elevation: 3227.543 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 25 Section: 16-13N-38W
HEAD OF TOP SPIKE IN THE N.E. FACE OF A POWER POLE IN THE N.E. CORNER
OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-23 County: KEITH
Elevation: 3258.430 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 25 Section: 16-13N-38W
HEAD OF TOP SPIKE IN THE NORTH FACE OF A POWER POLE ON THE 1/2 MILE
LINE AND ON THE NORTH SIDE OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-24 County: KEITH
Elevation: 3243.309 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 25 Section: 16-13N-38W
HEAD OF TOP SPIKE IN THE N.W. FACE OF A POWER POLE IN THE N.W. CORNER
OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-25 County: KEITH
Elevation: 3241.930 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 26 Section: 17-13N-38W
HEAD OF TOP SPIKE IN THE NORTH FACE OF A TRANSFORMER POLE 100 FEET
WEST OF 1/2 MILE LINE AND ON THE NORTH SIDE OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-26 County: KEITH
Elevation: 3238.586 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 26 Section: 7-13N-38W
HEAD OF TOP SPIKE IN THE S.E. FACE OF A POWER POLE IN THE S.E. CORNER
OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-27 County: KEITH
Elevation: 3281.471 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 27 Section: 18-13N-38W
HEAD OF TOP SPIKE IN THE WEST FACE OF BRACE POLE ON THE 1/2 MILE LINE
AND IN THE APPROX. CENTER OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-28 County: KEITH
Elevation: 3353.947 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 28 Section: 19-13N-38W
HEAD OF TOP SPIKE IN THE WEST FACE OF A CORNER POST ON THE 1/2 MILE
LINE IN THE EAST R.O.W. AND IN THE APPROX. CENTER OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-29 County: KEITH
Elevation: 3398.141 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 28 Section: 30-13N-38W
HEAD OF TOP SPIKE IN THE EAST FACE OF A CORNER POST ON THE MILE LINE
AND IN THE S.W. CORNER OF THE N.E. 1/4 OF THE N.W. 1/4 OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-30 County: KEITH
Elevation: 3215.428 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 29 Section: 8-13N-38W
HEAD OF TOP SPIKE IN THE SOUTH FACE OF A POWER POLE ON THE 1/2 MILE
LINE AND IN THE CENTER OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-31 County: KEITH
Elevation: 3206.438 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 30 Section: 9-13N-38W
HEAD OF TOP SPIKE IN THE SOUTH FACE OF A POWER POLE ON THE 1/2 MILE
LINE AND IN THE S.E. CORNER OF THE S.E. 1/4 OF THE N.W. 1/4 OF
SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-32 County: KEITH
Elevation: 3192.969 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 31 Section: 10-13N-38W
HEAD OF TOP SPIKE IN THE SOUTH FACE OF A TRANSFORMER POLE ON THE 1/2
MILE LINE AND IN THE S.W. CORNER OF THE S.W. 1/4 OF THE N.E. 1/4 OF
SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-33 County: KEITH
Elevation: 3243.722 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 32 Section: 7-13N-38W
HEAD OF TOP SPIKE IN THE SOUTH FACE OF A POWER POLE IN THE S.W.
CORNER OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-34 County: KEITH
Elevation: 3232.751 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 32 Section: 13-13N-39W
HEAD OF TOP SPIKE IN THE NORTH FACE OF A CORNER POST ON THE 1/2 MILE
LINE AND ON THE NORTH SIDE OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-35 County: KEITH
Elevation: 3240.848 Quad. OGALLALA SOUTHWEST
Book No. 1 Page No. 33 Section: 12-13N-39W
HEAD OF TOP SPIKE IN THE S.W. FACE OF A POWER POLE IN THE S.W. CORNER
OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-36 County: KEITH
Elevation: 3247.458 Quad. OGALLALA
Book No. 1 Page No. 38 Section: 1-13N-39W
HEAD OF TOP SPIKE IN THE S.W. FACE OF A POWER POLE AT THE S.W. CORNER
OF CEMETERY AND ON THE 1/2 MILE LINE AND ON THE WEST SIDE OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-37 County: KEITH
Elevation: 3265.775 Quad. OGALLALA
Book No. 1 Page No. 38 Section: 2-13N-39W
HEAD OF TOP SPIKE IN THE NORTH FACE OF FIRST POWER POLE EAST OF
TRANSFORMER POLE AND ON THE NORTH SIDE OF THE N.W. 1/4 OF THE S.E.
1/4 OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-38 County: KEITH
Elevation: 3254.859 Quad. OGALLALA
Book No. 1 Page No. 40 Section: 1-13N-39W
HEAD OF TOP SPIKE IN THE S.W. FACE OF A CORNER POST AT 'T'
INTERSECTION AND ON THE WEST SIDE OF N.W. 1/4 OF THE N.E. 1/4 OF
SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-39 County: KEITH
Elevation: 3262.887 Quad. BRULE SOUTHEAST
Book No. 2 Page No. 46 Section: 10-13N-39W
HEAD OF TOP SPIKE IN THE NORTH FACE OF A FENCE POST 50 FEET WEST OF
THE DRAIN ON THE NORTH SIDE OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-40 County: KEITH
Elevation: 3317.046 Quad. BRULE NORTHEAST
Book No. 2 Page No. 49 Section: 34-14N-39W
HEAD OF TOP SPIKE IN THE SOUTH FACE OF A FENCE POST 30 FEET WEST OF
THE DRAIN AND ON THE SOUTH SIDE OF THE S.W. 1/4 OF THE S.W. 1/4 OF
SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-41 County: KEITH
Elevation: 3349.989 Quad. BRULE NORTHEAST
Book No. 2 Page No. 51 Section: 33-14N-39W
HEAD OF THE TOP SPIKE IN THE EAST FACE OF A LARGE POST IN THE
NORTH-SOUTH FENCE AND WEST OF THE DRAIN AND ON THE APPROX. 1/2 MILE
LINE AND ON THE EAST SIDE OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-42 County: KEITH
Elevation: 3384.471 Quad. BRULE NORTHEAST
Book No. 2 Page No. 54 Section: 28-13N-39W
HEAD OF TOP SPIKE IN THE NORTH FACE OF THE FENCE POST 250 FEET WEST
OF DRAIN AND ON THE SOUTH SIDE OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-43 County: KEITH
Elevation: 3277.798 Quad. OGALLALA SOUTHWEST
Book No. 6 Page No. 27 Section: 16-13N-38W
HEAD OF TOP SPIKE IN THE SOUTH FACE OF A FENCE POST 75 FEET WEST OF
THE DRAIN AND ON THE SOUTH SIDE OF THE S.W. 1/4 OF SECTION.

Project: OGALLALA TRIBS Date : 11-86
Bench Mark No. TBM-DR-OT-44 County: KEITH
Elevation: 3325.113 Quad. OGALLALA SOUTHWEST
Book No. 6 Page No. 33 Section: 21-13N-38W
HEAD OF TOP SPIKE IN THE NORTHWEST FACE OF A CORNER POST 75 FEET EAST
OF THE DRAIN AND ON THE SOUTH SIDE OF THE S.W. 1/4 OF THE S.E. 1/4 OF
SECTION.

Project: OGALLALA TRIBS Date : 5-88
Bench Mark No. TBM-DR-OT-45 County: KEITH
Elevation: 3355.545 Quad. OGALLALA SOUTHWEST
Book No. 10 Page No. 6 Section: 19-13N-38W
HEAD OF TOP SPIKE IN THE EAST FACE OF A POWER POLE IN THE NORTHEAST
CORNER OF SECTION.

Project: OGALLALA TRIBS Date : 5-88
Bench Mark No. TBM-DR-OT-46 County: KEITH
Elevation: 3312.731 Quad. OGALLALA SOUTHWEST
Book No. 10 Page No. 7 Section: 17-13N-38W
HEAD OF TOP SPIKE IN THE WEST FACE OF A POWER POLE ON THE 1/2 MILE
LINE AND ON THE WEST SIDE OF SECTION.

Project: OGALLALA TRIBS Date : 5-88
Bench Mark No. TBM-DR-OT-47 County: KEITH
Elevation: 3296.664 Quad. OGALLALA SOUTHWEST
Book No. 10 Page No. 14 Section: 24-13N-39W
HEAD OF TOP SPIKE IN THE NORTHEAST FACE OF A POWER POLE IN THE
NORTHEAST CORNER OF SECTION.

Project: OGALLALA TRIBS Date : 5-88
Bench Mark No. TBM-DR-OT-48 County: KEITH
Elevation: 3340.285 Quad. OGALLALA SOUTHWEST
Book No. 10 Page No. 15 Section: 13-13N-39W
TOP OF LONE SPIKE IN THE SOUTHWEST FACE OF CORNER POST ON THE 1/2
MILE LINE AND ON THE SOUTH SIDE OF SECTION.

Project: OGALLALA TRIBS Date : 5-88
Bench Mark No. TBM-DR-OT-49 County: KEITH
Elevation: 3257.774 Quad. OGALLALA SOUTHWEST
Book No. 10 Page No. 17 Section: 14-13N-39W
HEAD OF TOP SPIKE IN THE EAST FACE OF POWER POLE IN THE WEST R.O.W.
ACROSS FROM DOUBLE POLE AND ON THE EAST SIDE OF SECTION.

Project: OGALLALA TRIBS Date : 5-88
Bench Mark No. TBM-DR-OT-50 County: KEITH
Elevation: 3259.467 Quad. OGALLALA SOUTHWEST
Book No. 10 Page No. 23 Section: 13-13N-39W
HEAD OF TOP SPIKE IN THE SOUTH FACE OF SOUTH BRACE POST IN THE
NORTH-SOUTH 1/2 MILE LINE FENCE.

Project: OGALLALA TRIBS Date : 5-88
Bench Mark No. TBM-DR-OT-51 County: KEITH
Elevation: 3275.563 Quad. OGALLALA SOUTHWEST
Book No. 10 Page No. 24 Section: 13-13N-39W
HEAD OF TOP SPIKE IN THE NORTH FACE OF A POWER POLE ON THE 1/2 MILE
LINE AND ON THE EAST SIDE OF SECTION.

Project: OGALLALA TRIBS Date : 5-88
Bench Mark No. TBM-DR-OT-52 County: KEITH
Elevation: 3234.576 Quad. BRULE SOUTHEAST
Book No. 10 Page No. 52 Section: 11-13N-39W
HEAD OF TOP SPIKE IN THE SOUTH FACE OF TRANSFORMER POLE AND ON THE
1/2 MILE LINE AND ON THE SOUTH SIDE OF SECTION.

Project: OGALLALA TRIBS Date : 5-88
Bench Mark No. TBM-DR-OT-53 County: KEITH
Elevation: 3236.752 Quad. BRULE SOUTHEAST
Book No. 10 Page No. 53 Section: 15-13N-39W
HEAD OF TOP SPIKE IN THE NORTHWEST FACE OF A CORNER POST ON THE EAST
SIDE OF DRAIN AND IN THE NORTHEAST CORNER OF SECTION.

Project: OGALLALA TRIBS Date : 5-88
Bench Mark No. TBM-DR-OT-54 County: KEITH
Elevation: 3250.718 Quad. BRULE SOUTHEAST
Book No. 10 Page No. 57 Section: 10-13N-39W
HEAD OF TOP SPIKE IN THE EAST FACE OF TRANSFORMER POLE AND IN THE
CENTER OF SECTION.

Project: OGALLALA TRIBS Date : 5-88
Bench Mark No. TBM-DR-OT-55 County: KEITH
Elevation: 3255.522 Quad. BRULE SOUTHEAST
Book No. 10 Page No. 58 Section: 9-13N-39W
HEAD OF TOP SPIKE IN THE EAST FACE OF POWER POLE ON THE 1/2 MILE LINE
AND ON THE EAST SIDE OF SECTION.

Project: OGALLALA TRIBS Date : 5-88
Bench Mark No. TBM-DR-OT-56 County: KEITH
Elevation: 3280.894 Quad. BRULE SOUTHEAST
Book No. 10 Page No. 65 Section: 3-13N-39W
HEAD OF TOP SPIKE IN THE SOUTH FACE OF CORNER POST AND IN THE
NORTHWEST 1/4 OF THE SOUTHEAST 1/4 SECTION.

Project: OGALLALA TRIBS Date : 5-88
Bench Mark No. TBM-DR-OT-57 County: KEITH
Elevation: 3272.130 Quad. BRULE NORTHEAST
Book No. 10 Page No. 66 Section: 3-13N-39W
HEAD OF TOP SPIKE IN THE SOUTHEAST FACE OF CORNER POST ON THE 1/2
MILE LINE AND ON THE EAST SIDE OF SECTION.

Project: OGALLALA TRIBS Date : 5-88
Bench Mark No. TBM-DR-OT-58 County: KEITH
Elevation: 3374.556 Quad. BRULE NORTHEAST
Book No. 11 Page No. 5 Section: 34-14N-39W
HEAD OF TOP SPIKE IN THE NORTH FACE OF CORNER OF POST ON THE SOUTH
SIDE OF SOUTHEAST 1/4 SECTION.

Project: OGALLALA TRIBS Date : 5-88
Bench Mark No. TBM-DR-OT-59 County: KEITH
Elevation: 3371.298 Quad. BRULE SOUTHEAST
Book No. 11 Page No. 6 Section: 34-14N-39W
HEAD OF TOP SPIKE IN THE NORTHEAST FACE OF POST AT NORTHWEST CORNER
OF POWER BOX AND IN THE SOUTHEAST CORNER OF SECTION.

Project: OGALLALA TRIBS Date : 5-88
Bench Mark No. TBM-DR-OT-60 County: KEITH
Elevation: 3301.632 Quad. BRULE NORTHEAST
Book No. 11 Page No. 8 Section: 35-14N-39W
HEAD OF TOP SPIKE IN THE SOUTHEAST FACE OF EAST BRACE POST ON 1/2
MILE LINE AND ON THE SOUTH SIDE OF SECTION.

Project: OGALLALA TRIBS Date : 5-88
Bench Mark No. TBM-DR-OT-61 County: KEITH
Elevation: 3302.661 Quad. OGALLALA
Book No. 11 Page No. 10 Section: 35-14N-39W
HEAD OF TOP SPIKE IN THE NORTHEAST FACE OF CORNER POST IN THE
SOUTHEAST CORNER OF SECTION.

Project: OGALLALA TRIBS Date : 5-88
Bench Mark No. TBM-DR-OT-62 County: KEITH
Elevation: 3324.753 Quad. OGALLALA
Book No. 11 Page No. 12 Section: 36-14N-39W
HEAD OF TOP SPIKE IN THE SOUTH FACE OF WEST FENCE CORNER POST ON THE
1/2 MILE LINE AND ON THE SOUTH SIDE OF SECTION.

Project: OGALLALA TRIBS Date : 5-88
Bench Mark No. TBM-DR-OT-63 County: KEITH
Elevation: 3373.130 Quad. OGALLALA
Book No. 11 Page No. 15 Section: 32-14N-38W
HEAD OF TOP SPIKE IN THE NORTHWEST FACE OF CORNER POST ON THE 1/2
MILE LINE AND ON THE EAST SIDE OF SECTION.

Project: OGALLALA TRIBBS
Bench Mark No. TBM MD OT 1
Elevation: 3376.739
Book No. 8 Page No. 6

Date : 5-88
County: KEITH
Quad. OGALLALA
Section: 31-14N-38W

HEAD OF TOP SPIKE IN WEST FACE OF A POWER POLE ON EAST SIDE OF HWY. 26 AND ON SOUTH SIDE OF DRIVE LEADING TO DEVOE'S SPORTS SHOP AND ON 1/2 MILE LINE NORTH SIDE OF SECTION.

Project: OGALLALA TRIBBS
Bench Mark No. TBM MD OT 2
Elevation: 3367.636
Book No. 8 Page No. 8

Date : 5-88
County: KEITH
Quad. OGALLALA
Section: 31-14N-38W

HEAD OF TOP SPIKE IN WEST FACE OF A POWER POLE ON EAST SIDE OF HWY. 26 OPPOSITE OF POWER SUB STATION AND IN CENTER OF SECTION.

Project: OGALLALA TRIBBS
Bench Mark No. TBM MD OT 3
Elevation: 3302.154
Book No. 8 Page No. 9

Date : 5-88
County: KEITH
Quad. OGALLALA
Section: 31-14N-38W

HEAD OF RAILROAD SPIKE IN WEST FACE OF A LIGHT POLE ON SOUTH SIDE OF HILLCREST DRIVE APPROX. 100 FEET EAST FROM CENTER LINE OF HWY. 26 AND ON 1/2 MILE LINE SOUTH SIDE OF SECTION.

Project: OGALLALA TRIBBS
Bench Mark No. TBM MD OT 4
Elevation: 3337.495
Book No. 8 Page No. 12

Date : 5-88
County: KEITH
Quad. OGALLALA
Section: 6-13N-38W

HEAD OF TOP SPIKE IN NORTH FACE OF A POWER POLE ON THE NORTHWEST CORNER OF SECTION.

Project: OGALLALA TRIBBS
Bench Mark No. TBM MD OT 5
Elevation: 3344.836
Book No. 8 Page No. 13

Date : 5-88
County: KEITH
Quad. OGALLALA
Section: 31-14N-38W

HEAD OF TOP SPIKE IN EAST FACE OF POWER LINE BRACE POLE ON EAST SIDE OF COUNTY ROAD AND JUST NORTH FROM 1/2 MILE LINE ON WEST SIDE OF SECTION.

Project: OGALLALA TRIBBS
Bench Mark No. TBM MD OT 6
Elevation: 3377.793
Book No. 8 Page No. 15

Date : 5-88
County: KEITH
Quad. OGALLALA
Section: 25-14N-39W

HEAD OF TOP SPIKE IN SOUTH FACE OF A POWER POLE ON THE SOUTHEAST CORNER OF SECTION.

Project: OGALLALA TRIBBS Date : 5-88
Bench Mark No. TBM MD OT 7 County: KEITH
Elevation: 3205.153 Quad. OGALLALA
Book No. 8 Page No. 20 Section: 5-13N-38W
HEAD OF RAILROAD SPIKE IN WEST FACE OF THE WEST TRIPLE POWER POLES ON SOUTH
SIDE OF ROAD SOUTH SIDE OF RAILROAD TRACKS AND APPROX. 800 FEET SOUTH FROM
CENTER OF SECTION.

Project: OGALLALA TRIBBS Date : 5-88
Bench Mark No. TBM MD OT 8 County: KEITH
Elevation: 3205.128 Quad. OGALLALA SW
Book No. 8 Page No. 23 Section: 5-13N-38W
HEAD OF TOP SPIKE IN EAST FACE OF THE NORTH FENCE CORNER BRACE POST ON NORTH
BANK OF SOUTH PLATTE RIVER AND NEAR THE SOUTHEAST CORNER OF THE SW 1/4 OF
THE SW 1/4 OF SECTION.

Project: OGALLALA TRIBBS Date : 5-88
Bench Mark No. TBM MD OT 9 County: KEITH
Elevation: 3280.637 Quad. OGALLALA
Book No. 8 Page No. 45 Section: 31-14N-38W
TOP OF FIRE HYDRANT ON THE NORTH END OF 'G' STREET AT A PRIVATE DRIVE ON THE
SOUTHEAST CORNER OF SECTION.

Project: OGALLALA TRIBBS Date : 5-88
Bench Mark No. TBM MD OT 10 County: KEITH
Elevation: 3266.167 Quad. OGALLALA
Book No. 8 Page No. 50 Section: 5-13N-38W
HEAD OF TOP SPIKE IN EAST FACE OF A POWER POLE ON 1/2 MILE LINE NORTH SIDE
OF SECTION.

Project: OGALLALA TRIBBS Date : 5-28-88
Bench Mark No. TBM MD OT 11 County: KEITH
Elevation: 3258.344 Quad. BRULE SE
Book No. 8 Page No. 56 Section: 10-13N-39W
HEAD OF TOP SPIKE IN NORTH FACE OF A TRANSFORMER POLE ON SOUTH SIDE OF ROAD
AND JUST WEST OF FARMSTEAD APPROX. 500 FEET WEST OF MILE LINE NEAR THE N.E.
CORNER OF SECTION.

Project: OGALLALA TRIBBS Date : 5-28-88
Bench Mark No. TBM MD OT 12 County: KEITH
Elevation: 3271.121 Quad. BRULE SE
Book No. 8 Page No. 59 Section: 9-13N-39W
HEAD OF TOP SPIKE IN NORTH FACE OF A POWER POLE ON THE NORTHEAST CORNER OF
THE SECTION.

Project: OGALLALA TRIBBS Date : 5-28-88
Bench Mark No. TBM MD OT 13 County: KEITH
Elevation: 3281.338 Quad. BRULE SE
Book No. 8 Page No. 60 Section: 9-13N-39W
HEAD OF TOP SPIKE IN NORTH FACE OF A POWER POLE ON SOUTH SIDE OF COUNTY ROAD
AND ON APPROX. N.W. CORNER OF THE NE 1/4 OF N.E. 1/4 OF SECTION.

Project: OGALLALA TRIBBS Date : 5-28-88
Bench Mark No. TBM MD OT 14 County: KEITH
Elevation: 3380.978 Quad. OGALLALA
Book No. 8 Page No. 62 Section: 31-14N-38W
HEAD OF TOP SPIKE IN WEST FACE OF THE SOUTH BRACE POST OF A FENCE CORNER AND
ON THE NE CORNER OF SECTION.

Project: OGALLALA TRIBBS Date : 5-28-88
Bench Mark No. TBM MD OT 15 County: KEITH
Elevation: 3395.648 Quad. OGALLALA
Book No. 8 Page No. 65 Section: 25-14N-39W
HEAD OF TOP SPIKE IN SOUTH FACE OF A POWER POLE ON NORTH SIDE OF COUNTY ROAD
LEADING TO A FARM HOUSE AND JUST WEST FROM 1/2 MILE LINE SOUTH SIDE OF
SECTION

Project: OGALLALA TRIBBS Date : 5-28-88
Bench Mark No. TBM MD OT 16 County: KEITH
Elevation: 3453.632 Quad. OGALLALA
Book No. 8 Page No. 67 Section: 25-14N-39W
HEAD OF TOP SPIKE IN SOUTH FACE OF A POWER POLE AT JCT. OF FENCE CORNERS AND
ON THE SOUTHWEST CORNER OF SECTION.

Project: OGALLALA TRIBBS Date : 5-28-88
Bench Mark No. TBM MD OT 17 County: KEITH
Elevation: 3345.888 Quad. OGALLALA
Book No. 8 Page No. 71 Section: 36-14N-39W
HEAD OF TOP SPIKE IN SOUTH FACE OF A POWER POLE AT JCT. OF 1/2 MILE LINES IN
CENTER OF SECTION.

Project: OGALLALA TRIBBS Date : 5-28-88
Bench Mark No. TBM MD OT 18 County: KEITH
Elevation: 3307.812 Quad. OGALLALA
Book No. 9 Page No. 9 Section: 31-14N-38W
HEAD OF TOP SPIKE IN SOUTH FACE OF A POWER POLE ON 1/2 MILE LINE EAST SIDE
OF SECTION.

Project: OGALLALA TRIBBS

Date : 5-28-88

Bench Mark No. TBM MD 0T 19

County: KEITH

Elevation: 3348.196

Quad. OGALLALA

Book No. 9 Page No. 11

Section: 32-14N-38W

HEAD OF TOP SPIKE IN SOUTH FACE OF A POWER POLE AT JCT. OF 1/2 MILE LINES IN
CENTER OF SECTION.

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